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THE FRESHWATER AND LAND CRAYFISHES OF AUSTRALIA.

By Ellen Clark.

(Plates I-XI.)

Freshwater and land crayfishes of the families Parastacidae and Austroastacidae are found throughout Australia and Tasmania. Eight genera, comprising thirty-two species, are now recorded, and there can be little doubt that many others will be found. Previous to this investigation the only systematic collecting was that of Messrs. S. W. Fulton, W. Kershaw and J. A. Kershaw, between 1870 and 1910. During the past two years collecting in Victoria and Tasmania has resulted in the discovery of seven new species.

With six exceptions, all the mainland species have been found in Victoria, the smallest of the States, where most attention has been paid to collecting, while only three species of one genus (*Cherax*) are known from the vast territory of Western Australia, probably due to lack of field work. Even in the arid districts of Central Australia Parastacidae are abundant, if one may judge from the material collected by the late Sir Baldwin Spencer during his expeditions in those regions. Parastacidae are known to exist in the Kimberley district, Western Australia, but so far no specimens have been received for examination.

Between fifteen hundred and sixteen hundred specimens have been examined. The majority are from Victoria and the eastern portion of South Australia; a large collection from the latter State was received on loan from the authorities of the South Australian Museum. Most species are represented by a series ranging from between twenty and sixty specimens, and in some instances hundreds of examples of the one species have been examined. In only one case two specimens have been available, and with the exception of seven species the types or paratypes of each species have been examined.

Until systematic collecting extends over the whole continent the distribution of the family will remain unknown, but distribution as far as at present known, is indicated by giving, after each specific description, a list of localities from which that species has been collected or recorded.

Australian species of Parastacidae are either aquatic or

terrestrial in habit, but a few species are equally at home in water and in burrows in dry or moist soil. Both aquatic and terrestrial forms crawl on land, especially in wet weather, and this habit probably accounts for their presence in artificial dams and ponds distant from natural lakes, swamps or water-courses.

In each genus there are both aquatic and terrestrial species. For example, in *Cherax* there are aquatic species (*bicarinatus*, *tenuimanus*); semi-aquatic, i.e., living in ponds and water-holes which often dry up during the summer months (*destructor*, *albidus*, *quinquecarinatus*); and terrestrial (*punctatus*). *Engaeus*, although usually a terrestrial genus, has species which live in creeks as well as on land in such localities as Skipton, Ferntree Gully and Marysville, Victoria.

Both aquatic and terrestrial species are burrowing animals; the former burrow in submerged, the latter in moist or dry soil. Aquatic species do much damage to retaining walls of channels and dams, and to banks of rivers and streams. Terrestrial species are sometimes serious pests in orchards where they burrow under roots of trees, and in some pastoral districts where large community burrows are numerous and collapse under the weight of cattle and horses. At Whitegate, a few miles from Benalla (Victoria), some areas riddled by yabbies are practically useless and are known as "crab-hole country."

Burrows of the various species of *Engaeus* are similar to those of the North American genus *Cambarus*, which have been described and figured by Ortmann, Abbott, Harris and Tarr, and the habits of both genera agree closely. Some species have burrows for only one occupant; others have community burrows for numerous occupants. The two genera also agree in including species which live in creeks as well as in burrows in soil. Ortmann's method of collecting specimens (1906, p. 345), by digging them out with a bayonet, is not much use when dealing with the Victorian species of *Engaeus*; a pick and shovel are the best collecting implements as many of the burrows descend six or seven feet.

Little has been published on the life history and habits of the Parastacidae. From observations made in Victoria and Tasmania during the past two years the breeding season is in spring, following the period of moulting, when numerous egg-bearing females were taken. During December and January females with newly-hatched young attached to the swimmerets were collected. While carrying eggs or young the females are particularly vicious, brandish their large chelae threaten-

ingly when approached, and attack any object placed near them. Except in the size of the abdomen and the position of the genital openings there are no external differences between the sexes, though the abdomen of the female is generally broader and longer than that of the male, especially in some terrestrial species.

Species of *Euastacus*, *Cherax* and *Engaeus* kept alive in observation tanks were fed on earthworms, raw meat, fish and tadpoles, all of which were torn to pieces by the chelate pereopods before being eaten. Examination of stomach contents shows that they also swallow mud and debris of the rivers, etc., in which they live.

Fully-grown specimens range in length from about 2 inches (*Pseudengaeus*) to 16 inches (*Euastacus* and *Astacopsis*). The largest of all known freshwater crayfishes belong to the two last-named genera. Specimens of *E. nobilis* (Dana) from the Thomson River, Victoria, weighed 5 lb. and measured 16 inches from the tip of the rostrum to the end of the telson; Smith records from Tasmania a specimen of *Astacopsis* that measured 16 inches and weighed 8 lb. Except in the large spiny or tuberculate species, there is little difference between immature and mature specimens of one species. Immature specimens of spiny species are comparatively free from spines and they gradually acquire the adult armature with each successive moult. Immature specimens of known species have been described as new species on several occasions.

My thanks are due to Dr. Isabella Gordon, Dr. W. T. Calman and W. E. Barnett, of the British Museum, for comparing specimens with the type material of Gray, and for the loan of specimens; to the various museums and institutions in Australia that loaned or donated material; to Mr. R. M. Murray, of Mt. Lyell, Tasmania, who collected specimens of *Astacus tasmanicus* Erichson; to Miss H. Alexander, Mr. A. Blain and Mr. E. Nelson for collections of Western Australian species; to numerous other collectors for material; and to Mr. K. A. Lodewyckx, of the Public Library of Victoria, who translated papers by Erichson, von Martens and Hess.

Tribe ASTACURA.

Definition of the tribe (after Huxley, "The Crayfish," 1880, p. 254):

"Multicellular animals provided with an alimentary canal and with a chitinous cuticular exoskeleton; with a ganglionated central nervous

system traversed by the œsophagus; possessing a heart and branchial respiratory organs.

"The body is bilaterally symmetrical, and consists of twenty metameres (or somites and their appendages), of which six are associated into a head, eight into a thorax, and six into an abdomen. A telson is attached to the last abdominal somite.

"The somites of the abdominal region are all free, those of the head and thorax, except the hindermost, which is partially free, are united into a cephalothorax, the tergal wall of which has the form of a continuous carapace. The carapace is produced in front into a rostrum, at the sides into branchiostegites.

"The eyes are placed at the ends of movable stalks. The antennules are terminated by two filaments. The exopodite of the antenna has the form of a mobile scale. The mandible has a palp. The first and second maxillae are foliaceous; the second being provided with a large scaphognathite. There are three pairs of maxillipedes, and the endopodites of the third pair are narrow and elongated. The next pair of thoracic appendages is much larger than the rest, and is chelate, as are the two following pairs, which are slender ambulatory limbs. The hindmost pairs of thoracic appendages are ambulatory limbs, like the foregoing, but not chelate. The abdominal appendages are small swimmerets, except the sixth pair, which are very large, and have the exopodite divided by a transverse joint.

"All the crayfishes have a complex gastric armature. The seven anterior thoracic limbs are provided with podobranchiae, but the first of these is always more or less completely reduced to an epipodite. More or fewer arthrobranchiae always exist. Pleurobranchiae may be present or absent."

Key to Families of ASTACURA.

First abdominal somite of male, and usually of female, provided with appendages.

First antennae each with two well-developed flagella. Outer rami of uropods with transverse sutures ASTACIDAE

First abdominal somite devoid of appendages in either sex.

First antennae each with two well-developed flagella. Outer rami of uropods with transverse sutures. Carapace not vaulted posteriorly

PARASTACIDAE Huxley

First antennae with the secondary flagellum reduced or absent. Outer rami of uropods without transverse sutures. Carapace strongly vaulted posteriorly AUSTROASTACIDAE fam. nov.

Family PARASTACIDAE Huxley.

Proc. Zool. Soc., Lond., p. 775, 1878.

Astacidae (*Astacinae*) Dana, U.S. Explor. Exped., xiii, Crust., pt. i, p. 520, 1852.

Astacidae, Miers, Cat. N.Z. Crust., p. 71, 1876; McCoy, Prodr. Zool. Victoria, i, Dec. 2, p. 17, 1878; l.c., Dec. 3, p. 45, 1879; Spence-Bate, Report Voy. H.M.S. *Challenger*, Crust. Macr., xxiv, 1888, p. 192.

Astacidae (*Parastacinae*) Haswell, Cat. Austrl. Mus., Crust., p. 174, 1882; McCoy, Prod. Zool. Victoria, ii, Dec. 16, p. 225, 1888; Faxon, Proc. U.S. Nat. Mus., xx, p. 668, 1898.

Parastacidae Huxley, Proc. Zool. Soc., Lond., 1878, p. 775; The Crayfish, International Scientific Series, xxvii, 1880, p. 306; Ortmann, Proc. Amer. Phil. Soc., xli, p. 291, 1902; Smith, Cambridge Nat. Hist. iv, p. 157, 1909; Smith, Proc. Zool. Soc. Lond., 1912, pp. 144-170; Smith and Schuster, Proc. Zool. Soc. Lond., 1913, pp. 112-127; Faxon, Mem. Mus. Comp. Zool., xl, No. 8, p. 402, 1914; Hale, Handbook Crust. Sth. Austrl., 1927, p. 74.

First abdominal somite devoid of appendages in either sex.

Podobranchs without a bilobed plaited lamina, although the stem may be expanded into a wing. Epipod of first maxilliped generally furnished with branchial filaments.

Telson usually without transverse suture; in some cases, however, more or less completely divided by a transverse suture.

In "The Crayfish," p. 307, fig. 76, Huxley figured an Australian Crayfish (to which he assigns no name) showing a very distinct transverse suture on the telson; but the family character given on p. 256 is "The telson is never divided by a transverse suture." As three species of Australian crayfishes have the telson more or less completely divided by a transverse suture, and except in this feature and in having the abdomen heavily armed with spines and tubercles they do not differ sufficiently from others of the group to justify the erection of a new family, the diagnosis of the family as set out above has been enlarged to include them.

Key to genera of PARASTACIDAE Huxley.

Telson more or less completely divided by a transverse suture, membranous posteriorly.

Stems of podobranchs each laterally produced into a broad wing-like expansion, covered by numerous hooked setae.

Second antennae inserted at the side of first.

Abdomen usually furnished laterally with three rows of large spines or tubercles; lateral margins rounded. Lateral lobes on first somite large and rounded EUASTACUS gen. nov.

Telson without transverse suture; posterior half of telson and uropods membranous.

Stems of podobranchs each laterally produced into a broad wing-like expansion, bearing numerous hooked filaments.

Second antennae inserted at the side of first.

Abdomen without spines or tubercles, lateral margins rounded. Lateral lobes on first somite large and rounded CHERAX Erichson

Telson without transverse sutures, entirely calcareous.

Stems of podobranchs each laterally produced into a small wing-like expansion, bearing a few hooked filaments.

Second antennae inserted at the side of the first.

Abdomen without spines or tubercles, lateral margins rounded. Lateral lobes on first abdominal somite small and rounded. Sternal keel narrow, continued across the obsolete posterior pair of lateral processes GEOCHARAX gen. nov.

Stems of podobranchs without lateral wing-like expansion.

Second antennae inserted at the side of the first.

Abdomen without spines or tubercles, except on pleura of second somite; lateral margins round or pointed. Lateral lobes on first somite large and rounded ASTACOPSIS Huxley

Second antennae inserted under the first.

Abdomen without spines or tubercles, lateral margins rounded.

Pleurobranchs present, gill formula $21 + \text{epr}$.

Sternal keel narrow, posterior pair of lateral processes single, large and grooved. First abdominal somite without lateral lobes

ENGAEUS Erichson

Sternal keel broad and swollen, posterior pair of lateral processes appearing double. First abdominal somite without lateral lobes

PSEUDENGAEUS gen. nov.

No pleurobranchs present, branchial formula $12 + 5r + \text{epr}$. First abdominal somite with lateral lobes large and rounded

PARASTACOIDES gen. nov.

Genus EUASTACUS gen. nov.

Cancer Shaw, Zool. of New Holland, i, p. 21, pl. 8, 1794.

Astacoides Dana, U.S. Explor. Exped., Crust., pt. i, p. 526, 1852; Heller, Reise Novara, Crust., p. 102, 1865; von Martens, Ann. Mag. Nat. Hist., ser. 3, xvii, p. 359, 1866; McCoy, Prodromus Zool. Victoria, i, 1879, p. 17.

Astacus McCoy, Ann. Mag. Nat. Hist., ser. 3, xx, 1867, p. 189; Heller, Reise Novara, Zool., ii, pt. 3, Crust., 1865, p. 100; von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 615.

Astacopsis Haswell, Cat. Austrl. Mus., Crust., p. 175, 1882; Spence-Bate, "Challenger" Reports, xxiv, 1888, p. 195; Smith, Proc. Zool. Soc. Lond., p. 154, 1912; Faxon, Mem. Mus. Comp. Zool., xl, 8, p. 402, 1914; Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 669; McCulloch, Rec. Austrl. Mus., No. 11, 1917, p. 237; Hale, Handbook Crust. Sth. Austrl., 1927, p. 75.

Carapace furnished with large spines or tubercles; rostral carinae tuberculate or spinous. Cervical groove deeply impressed, rounded.

Abdomen usually with three or more rows of spines or tubercles laterally, lateral margins rounded. First somite with lateral lobes large and rounded. Telson more or less completely divided by a transverse suture, membranous posteriorly.

Second antennae set at the side of the first; squames large. Upper lip long and narrow, straight or somewhat concave medianly.

Vas deferens on simple short papillae on coxae of fourth pereopods.

Stems of podobranchs each produced into a broad wing-like expansion (Plate I, fig. 1), covered by numerous long setae, terminated by sharply recurved hooks. Last posterior arthrobranch small. Gill formula $21 + \text{epr}$.

Genotype *Cancer serratus* Shaw.

Previous authors have referred the various species of this genus to *Astacopsis* Huxley, which is based on the Tasmanian Crayfish, *A. gouldi* sp. nov. (= *A. franklinii* Huxley, non Gray). *Euastacus* is separated from *Astacopsis*, as now restricted, by three important characters:

1. The form of the gills. In *Astacopsis* (Plate I, fig. 2) the podobranchs have no broad wing-like expansion, and the stem is continued to the apex of the gill. In *Euastacus* (Plate I, fig. 1) the stems of the podobranchs are each laterally produced into a broad wing-like expansion, and the stem is not continued to the apex.

2. The telson of *Astacopsis* is entirely calcareous, without trace of transverse sutures. The telson of *Euastacus* is membranous posteriorly, and more or less completely divided by a transverse suture.

3. The abdomen of *Astacopsis* is smooth, except for four or five small spines on the pleura of the second abdominal somite. The abdomen of *Euastacus*, especially in adult examples, usually has three or more rows of large spines or tubercles laterally on each somite.

Key to species of EUASTACUS gen. nov.

Rostrum twice as long as broad at base.

Abdomen shorter than carapace, furnished with three, sometimes four, rows of large sharp spines laterally on each somite.

Second antennae reaching beyond end of telson

SERRATUS (Shaw)

Carapace and abdomen densely covered by short downy setae

s.sp. HIRSUTUS (McCulloch)

Abdomen as long as carapace, furnished with two, sometimes three, rows of large spines laterally on each somite.

Second antennae reaching to third abdominal somite

YARRAENSIS (McCoy)

Rostrum one-fourth longer than broad at base.

Abdomen longer than carapace, furnished with three sharp spines laterally on each somite; dorsum of first four segments raised to a large tumid ridge.

Carapace studded with numerous small tubercles; six or seven large tubercles in an irregular row on dorsum of branchiostegites

NOBILIS (Dana)

Carapace sparsely studded with small tubercles on branchiostegites

s.sp. KERSHAWI (Smith)

Abdomen longer than carapace, without spines or tubercles, except on lateral margins FLECKERI (Watson)

Euastacus serratus (Shaw).

(Pl. I, fig. 1; Pl. II, fig. 12.)

Cancer serratus Shaw, Zool. of New Holland, i, 1794, p. 21, pl. 8.*Astacus serratus* Gray, Eyre's Journ. Exped. Disc. Cent. Austrl., i (Appendix), p. 409, 1845; McCoy, Ann. Mag. Nat. Hist., ser. 3, xx, p. 189, 1867; von Martens, Monats. Akad. Wiss. Berlin, p. 615, 1868.*Potamobius serratus* White, Proc. Zool. Soc. Lond., 1850, xviii, p. 95, pl. 15.*Astacoides serratus* McCoy, Prodromus Zool. Victoria, i, 1879, p. 17, pl. 15.*Astacopsis serratus* Haswell, Cat. Austrl. Mus., Crust., 1882, p. 174; Ortmann, Proc. Amer. Philos. Soc., xli, p. 292, 1902; Smith, Proc. Zool. Soc. Lond., p. 157, pl. 16, 1912; McCulloch, Rec. Austrl. Mus., No. 11, p. 237, 1917; Hale, Handbook Crust. Sth. Austrl., 1927, p. 75.*Astacoides spinifer* Heller, Reise Novara, Zool., ii, pt. 3, Crust., 1865, p. 102.*Astacopsis spinifer* Spence-Bate, "Challenger" Reports, xxiv, 1888, p. 195, pl. 28; Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 670; Faxon, Mem. Mus. Comp. Zool., xl, 1914, p. 402.*Astacus armatus* von Martens, Ann. Mag. Nat. Hist., ser. 3, xvii, 1866, p. 359.*Astacopsis sydneyensis* Spence-Bate, "Challenger" Reports, xxiv, 1888, p. 204, pl. 23.*Astacus australasiensis* Milne-Edwards, Hist. Nat. Crust., ii, p. 332, pl. 24, figs. 1-5, 1837; Audouin and Milne-Edwards, Arch. du Mus. d'Hist. Nat., ii, 1841, p. 36; Erichson, Arch. f. Naturg., xii, 1846, p. 94; Heller, Reise Novara, Crust., 1865, p. 100; von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 618; Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 675.*Astacopsis australasiensis* Haswell, Cat. Austrl. Mus., Crust., 1882, p. 178; Faxon, Mem. Mus. Comp. Zool., xl, 1914, 8, p. 351.

Length of average adult specimen, 300 mm.

Rostrum twice as long as broad at base, apex long and sharp; carinae sharp, with four or five sharp spines; a sharp spine at base of each carina, with another posterior-laterally to it.

Second antennae reaching beyond end of telson; squame smooth, inner lobe broad, terminal spine long and stout. Interantennal spine triangular, ending in a blunt point, lateral margins smooth or feebly serrated.

Carapace twice as long as broad, broader than high, longer than abdomen. Branchiostegites studded with numerous small tubercles, and eight to twelve sharp spines in an irregular row on upper margin.

First abdominal somite with two sharp spines on each lateral lobe; second with two spines on lateral margin, remaining somites each with a long sharp spine on lateral margin; four long sharp spines on dorsum of each somite, spines very small on sixth somite.

Telson broad, slightly longer than broad, almost completely divided by a transverse suture, with a spine on each lateral margin at suture and five small spines on surface; inner rami of uropods each with a spine on lateral margins,

median carina feeble, ending in a sharp spine near posterior margin; outer rami of uropods each with numerous spines along transverse suture, some examples having two or three small spines on outer lateral margin. Lobes at base of uropods without spines.

Sternal keel rounded below first and second pereopods, sharp below great chelae; first pair of lateral processes very small and sharp, second pair larger, and third pair four times as large as first, rounded; posterior pair large, blunt, and deeply grooved; processes between fourth pereopods long and stout.

Great chelae stout, propodus two and one-half times as long as broad, upper margin with four sharp spines, lower margin with a double row of sharp spines, cutting edge with two large and several small tubercles; dactylus with several small tubercles on cutting edge, upper margin usually smooth, sometimes with one or two small sharp spines. Carpus with two long sharp spines on upper margin, upper surface deeply grooved; mcrus with three large and five small sharp spines on upper margin.

Colour.—The colour, chiefly in shades of blue and bluish-green, is subject to considerable variation at all stages of growth. McCulloch (1917) records bright pink examples from the Blue Mountains, New South Wales. In specimens received alive from Dr. W. J. Harris, of Echuca, Victoria, the carapace, abdomen and pereopods varied from light blue to very dark blue, but some were a light greenish-blue; the dorsum of the carapace, spines on carapace, abdomen and pereopods, and the whole of the great chelae, white.

Great variation is shown in the number and position of the spines in individuals of all sizes, particularly those on the rostrum and telson. In the series from Echuca no two examples are identical; some have numerous small spines on the upper surface of the telson, others only two or three spines, others again spines on the lateral margins only. In some specimens the rostrum has five spines on each side; one has three spines on one side and two on the other; another has one spine at each side of the apex and two very small tubercles behind the spines. The spines on the branchiostegites and abdomen also vary in number and size.

Habitat.—Murray River and its tributaries in Victoria, New South Wales and South Australia; Brisbane Waters (White, 1850).

Described from a series of 60 specimens ranging in length from 50 mm. to 300 mm., from various localities in Victoria, New South Wales and South Australia. It is popularly known as the Murray Lobster, or Murray Crayfish.

Local Varieties.—A series of seven specimens from the Jamieson River (A. Hordern, 1935) and a series of nine from the Goulburn and Howqua Rivers (E. Clark, 1935), although fairly close to *serratus* in general characters, differ in having the spines on the carapace very small and less numerous; and the second antennae barely reach the base of the telson. The largest examples (212 mm.) were cross green on the carapace, abdomen and pereopods, with the great chelae and all the spines white; a few examples were entirely green. Many of the smallest (90 mm.) were entirely dark reddish-brown, with the spines more reddish.

Specimens from Buffalo River, Victoria (E. Clark, 1935), agree in general characters with *serratus* but the great chelae are very short and stout as in *yarraensis*, and the spines on the branchiostegites are smaller and less numerous than in *serratus*. Colour as in *serratus*.

Euastacus serratus s.sp. *hirsutus* (McCulloch).
(Pl. II, fig. 14.)

Astacopsis serratus var. *hirsutus* McCulloch, Records, Australian Museum, No. 11, 1917, p. 238, pl. 43.

Male.—Length, 82 mm.

General characters as in *serratus*. Carapace and abdomen devoid of spines and tubercles, but densely covered by short setae. Carpus of great chelae with three spines on upper margin where *serratus* has two.

Habitat.—*New South Wales*: Belmore Falls Creek, Kangaroo River (type locality).

Types in the Australian Museum, Sydney.

Described from two paratypes received on loan from the Australian Museum, Sydney.

Euastacus yarraensis (McCoy).
(Pl. II, fig. 13.)

Astacopsis serratus Shaw var. *yarraensis* McCoy, Prodromus Zool. Victoria, ii, Dec. 16, 1888, p. 225, pl. 16.

Length of average adult specimen, 300 mm.

Rostrum twice as long as broad at base, apex long and sharp; carinae sharp, each with three or four small sharp spines; two blunt spines on carapace posterior-laterally to carinae.

Second antennae stout, reaching to third abdominal somite; squame smooth, inner lobe broad, terminal spine long and stout. Interantennal spine triangular, long, sharply pointed, lateral margins serrated.

Carapace twice as long as broad, broader than high, as long as abdomen; branchiostegites with numerous small tubercles and an irregular row of six to nine large tubercles on upper margin.

First abdominal somite with a small sharp spine on lateral lobes, second somite with three sharp spines along lateral margins, three following somites with a sharp spine on lateral margins and a smaller one immediately above it, and a large sharp spine nearer dorsum of somite; most examples have a row of small blunt tubercles on dorsum.

Telson longer than broad, almost completely divided by a transverse suture, posterior half membranous; ten to fifteen sharp spines present on surface, and a spine on each lateral margin at suture; inner rami of uropods each with two sharp spines marking the obsolete median carina, one spine on outer lateral margin near posterior margin; outer rami each with an obsolete longitudinal median carina, numerous sharp spines along transverse suture, and three spines on outer lateral margins. Lobes at base of uropods without spines.

Great chelae stout, propodus almost twice as long as broad, upper margin with four blunt spines, lower margin with a double row of short blunt spines, cutting edge with two large tubercles; upper margin of dactylus smooth, cutting edge with six or seven large tubercles; two sharp spines on under surface at base of dactylus. Carpus with one large and one small spine on upper margin; merus with four or five large and three small spines on upper margin.

Habitat.—*Victoria*: Yarra River (type locality); Yea River (Yea State

School, 1935); Plenty River (S. A. Kearnland, 1896); Barwon River (W. Kershaw, 1879); Watts River (S. W. Fulton, 1898); Kennedy's Creek (W. A. Hall, 1897); Badger Creek (F. J. Williams, 1905).

Type in National Museum, Melbourne.

Described from a series of 40 specimens ranging in length from 90 mm. to 300 mm. The type of the species is a half-grown specimen 110 mm. long. Specimens equalling in size the largest *E. serratus* have been received by the National Museum since the species was described by McCoy.

Readily separated from *E. serratus* by the very broad, highly-arched abdomen; the longer telson and uropods, and the reduction in size and number of spines on the carapace and abdomen; also by the great chelae being shorter and stouter, and the second antennae much shorter than in *serratus*.

Euastacus nobilis (Dana).

(Pl. III, fig. 15.)

Astacoides nobilis Dana, U.S. Explor. Exped., Crust., pt. 1, 1852, p. 526, pl. 33.

Astacoides nobilis Hess, Archiv. f. Naturg., xxxi, 1865, p. 164; Heller, Reise Novara, Zool., ii, pt. 3, Crust., 1865, p. 101; von Martens, Ann. Mag. Nat. Hist., ser. 3, xvii, p. 360, 1866.

Astacus nobilis von Martens, Monatsber. Akad. Wiss. Berlin, p. 616, 1868.

Astacopsis nobilis Haswell, Cat. Austrl. Mus., Crust., 1882, p. 175; Faxon, Proc. U.S. Nat. Mus., xx, p. 675, 1898; Faxon, Mem. Mus. Comp. Zool., x1, 8, 1914, p. 402.

Astacopsis serratus Smith, Proc. Zool. Soc. Lond. 1912, p. 157.

Astacopsis paramattaensis Spence-Bate, "Challenger" Reports, xxiv, p. 202, 1888; Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 675.

Length of average adult specimen, 320 mm.

Rostrum one-fourth longer than broad at base, apex short and blunt; lateral carinae sharp with three or four blunt spines; a blunt spine at base of carinae, and a large rounded boss posterior-laterally to it.

Second antennae reaching fourth abdominal somite, squame smooth, inner lobe short and broad, sloping to a long sharp terminal spine. Interantennal spine rather long and narrow, bluntly pointed.

Carapace twice as long as broad, broader than high, somewhat shorter than abdomen; branchiostegites studded with numerous small tubercles, and six or seven large round tubercles in an irregular row on upper margin; two or three sharp spines on anterior margin.

First abdominal somite with a long sharp spine on lateral lobes; second with three long sharp spines on lateral margins, and a long spine above third; remaining somites each with three sharp lateral spines; dorsum of first four somites raised to large tumid ridges, occupying half the width of the somite.

Telson almost completely divided at middle by a transverse suture, posterior half membranous; rather short, with a spine on each lateral margin at suture,

and eight or nine spines on surface; some examples with three spines on lateral margins, and four spines on surface. Inner rami of uropods each with three sharp spines marking the obsolete median carina, three large and several small spines on outer lateral margin; outer rami each with numerous sharp spines along transverse suture. Lobes at base of uropods with a spine on upper lobe.

Sternal keel moderately sharp; first pair of lateral processes small and round, increasing in size and sharpness to posterior, the latter large and deeply grooved.

Great chelae stout, propodus twice as long as broad, upper margin with four small blunt spines, lower margin with a double row of numerous small sharp spines, cutting edge of propodus with two large and a few small tubercles; dactylus with several small tubercles on cutting edge, and six or seven blunt spines on upper margin. Carpus with three long sharp spines on upper margin, upper surface deeply grooved; merus with four large sharp spines and a few small spines on upper margin.

Habitat.—*New South Wales*: Sydney (W. Kershaw, 1890); Wollongong; Parramatta River; Mt. Kosciusko; Blue Mountains. *Queensland*: Stanthorpe; Moreton Bay. *Victoria*: Bruthen (J. Barling, 1918); Narracan River (W. Kershaw, 1890); Thomson River (R. James, 1936).

Euastacus nobilis s.sp. *kershawi* (Smith).

(Pl. III, fig. 16.)

Astacopsis kershawi Smith, Proc. Zool. Soc. Lond., 1912, p. 160.

Rostrum, antennae, squame, interantennal spine and sternal keel as in *E. nobilis*.

Carapace twice as long as broad, somewhat shorter than abdomen; branchiostegites sparsely studded with small tubercles.

Abdomen as in *E. nobilis*, but telson and uropods longer.

Great chelae as in *nobilis* but less spinose. Carpus with two sharp spines on upper margin, in some examples.

Colour.—The colour varies from deep olive-green to mid bluish-green on carapace, abdomen, pereopods and great chelae, tinged with red on the tips of the spines and tubercles, and on the basal portions of the pereopods, the bases of the antennae, and on the posterior portion of the branchiostegites, and the membranous portion of telson and uropods. A few examples in the series are brownish-green, with the spines on body and the whole of the great chelae bright blue, pereopods dull reddish-brown.

Habitat.—*Victoria*: Moe River (type locality) (W. Kershaw, 1886); Thorpdale (W. Kershaw, 1888); Bunyip River (W. Kershaw, 1888); Fern-tree Gully (S. W. Fulton, 1906); Warburton (F. J. Williams, 1905); Vereker Range, Wilson's Promontory (J. A. Kershaw, 1913); Glenelg River, near junction with Limestone Creek (H. Pritchard, 1935); Crawford River (J. H. McEachern, 1936).

Types in National Museum, Melbourne.

Dana (1852) described and figured *Astacoides nobilis*, which he queried inhabited New South Wales. Huxley (1880) considered *nobilis* identical with *armatus* (*serratus*). Haswell (1882) quoted Dana's description, adding that it was probably identical with *A. franklinii* (Gray). Faxon (1898) listed

the name and considered the species valid, possibly the Australian representative of *A. franklinii*. Smith (1912) placed *nobilis* in the synonymy of *serratus* (Shaw) from the Parramatta River, and described a new species, *A. kershawi*, from Victoria. For reasons given below I consider *A. nobilis* to be a valid species and *A. kershawi* to be a subspecies of it.

In the material examined *E. nobilis* and *E. nobilis* s.sp. *kershawi* are represented by eighty individuals ranging in length from one and one-half inches to eleven inches from tip of rostrum to end of telson. The series includes the three large specimens on which Smith founded *A. kershawi*, and eleven small which he called the Local Variety or Small Gippsland Crayfish.

The smallest in the series have the body smooth or with very minute scattered tubercles on the branchiostegites; on examples three inches long the tubercles are more pronounced. Specimens five inches long have the tubercles larger, but not prominent, agreeing in all details with Dana's description. Examples seven inches long have the tubercles on the carapace similar to those of the adults, the row of large tubercles on the dorsum of the branchiostegites being prominent; and the large tubercle-like ridges on the first four abdominal somites are noticeable. The largest specimens have very large tubercles on the dorsum of the branchiostegites, thus differing from those described by Smith as *A. kershawi*.

Specimens of *nobilis* and *kershawi* are separated at all stages by the size of the telson and uropods, which are larger in *kershawi*, and by the large tubercles on the carapace of *nobilis* which are absent in *kershawi*, although two specimens of *kershawi* have two or three fairly large tubercles on one side only. As the differences are constant, although so slight, *kershawi* is retained as a subspecies of *nobilis*.

Euastacus fleckeri (Watson).

(Pl. III, fig. 17.)

Astacopsis fleckeri Watson, Mem. Queensland Mus., x, pt. v, 1935, p. 232, pl. xxxiv; l.c., xi, pt. 1, 1936, p. 52. Flecker, Nth. Queensland Nat., iv, 41, 1936, pp. 18-20.

Length of largest specimen examined, 210 mm.

Rostrum slightly longer than broad at base, apex rounded; lateral carinae blunt, each with three or four small tubercles; a small tubercle at base of each carina.

Second antennae reaching to base of telson; squame smooth, inner lobe broad, terminal spine short and sharp. Interantennal spine long and narrow, sharply pointed, margins serrated.

Carapace twice as long as broad, broader than high, somewhat shorter than abdomen. Branchiostegites studded with numerous small tubercles.

First abdominal somite with a long sharp spine on lateral lobes; second with four or five sharp spines on lateral margins; remaining somites each with one spine on lateral margin. No other spines or prominences on abdomen.

Telson longer than broad, almost completely divided at posterior third by a transverse suture, posterior third membranous; a small spine on each lateral margin at suture, without other median or lateral spines. Inner rami of uropods with obsolete median carina ending in a small blunt spine almost on posterior margin, a small blunt spine at posterior third of outer margin. Outer rami each with numerous small spines along transverse suture. Lobes at base of uropods smooth.

Sternal keel moderately sharp; first pair of lateral processes small and round, increasing in size and sharpness to posterior pair, these large and deeply grooved.

Great chelae stout, propodus more than twice as long as broad, upper margin with four small blunt spines, cutting edge of propodus with one large and three or four small tubercles on cutting edge, upper margin smooth or with one or two small tubercles. Carpus with four or five sharp spines along upper margin, upper surface flat; merus with four or five small spines on upper margin.

Habitat.—*North Queensland*: Root's Creek (type locality); Mossman River and its tributaries.

Type in the Queensland Museum, Brisbane.

Readily separated from *E. nobilis*, which it somewhat resembles, by the absence of spines or tubercles from the dorsum of the abdominal somites, the absence of spines on the telson and uropods, and by the form of the carpus. Redescribed from three specimens, two females and one male, received from the authorities of the Queensland Museum.

The species was described from a single specimen stated to be a male. An examination, however, shows the specimen to be a female. Flecker (1936), dealing with the habits and haunt of the species, also alludes to the type as a male.

Genus CHERAX Erichson.*

Astacus (*Cherax*) Erichson, Arch. f. Naturg., xii, pp. 88-89, 1846.

Astacus (*Cheraps*) Erichson, l.c., p. 101.

Astacus Gray, Eyre's Journ. Exped. Disc. Cent. Austrl., i (Appendix), 1845, p. 410; von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 164.

Astacoides Hess, Arch. f. Naturg., xxxi, 1865, p. 164; McCoy, Prod. Zool. Victoria, i, Dec. 3, 1879, p. 45.

Astacopsis Haswell, Cat. Austrl. Mus., Crust., p. 177, 1882; Spencer and Hall, Rep. Horn Exped. Centr. Austrl., pt. ii, Zool., p. 244, 1896.

Cheraps Huxley, Proc. Zool. Soc. Lond., 1878, p. 769; Smith, Proc. Zool. Soc. Lond., 1912, p. 165.

*For notes on the generic definition of *Cherax* see page 50.

Cheraps Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 671; Ortmann, Proc. Amer. Philos. Soc., xli, 1902, p. 291; Faxon, Mem. Mus. Comp. Zool., xl, 8, p. 403, 1914; McCulloch, Rec. West. Austrl. Mus., i, pt. 3, p. 229, 1914.

Parachaeraps Smith, Proc. Zool. Soc. Lond., 1912, p. 165; McCulloch, Rec. West. Austrl. Mus., i, pt. 3, p. 234, 1914; Hale, Austrl. Mus. Mag., ii, No. 8, p. 271, 1925; Hale, Handbook Crust. Sth. Austrl., 1927, p. 73.

Carapace punctate, sometimes tuberculate; lateral carinae of rostrum feeble or conspicuously sharp. Cervical suture deeply impressed, rounded.

Abdomen longer than carapace, either punctate or tuberculate; lateral margins rounded. First somite with lateral lobes large and rounded. Telson and uropods each half calcareous and half membranous. Telson without a transverse suture.

Second antennae set at the side of first; squame large. Upper lip long and narrow, straight or slightly concave medianly.

Vas deferens on long projecting papillae on coxae of fourth pereopods.

Stems of podobranchs (Pl. i, fig. 3) each produced into a broad wing-like expansion bearing numerous hooked filaments. Last posterior arthrobranch very small. Gill formula 21 + epr.

Erichson (1846) divided the genus *Astacus* into five subgenera to which he gave a key (p. 88). In this key the name of the fourth subgenus is *Cherax*, and in the next two pages it is referred to repeatedly as *Cherax*. In the description of the subgenus and the new species (p. 94) the name is spelt *Cheraps*, and on p. 376 he again refers to it as *Cheraps*. All subsequent authors have used the name *Cheraps*, or misspelt it *Chaeraps*. Since *Cherax* is the name first given to the subgenus, it must stand.

My friends who are Greek scholars consider that, since there are no such Greek words as *Cherax* or *Cheraps*, the generic name *Cherax* is evidently a misspelling of the word *Charax* (*Χάραξ*), a pointed stake (i.e., a thing that scratches), derived from the verb *χαράσσειν*, to furrow, engrave or scratch a mark.

Key to species of CHERAX Erichson.

Rostrum four times as long as broad at base.

Five carinae on carapace.

Squame of second antennae reaching beyond the third segment of second antennae.

Great chelae long and slender, propodus two and one-half times longer than broad, dactylus long and slender

TENUIMANUS (Smith)

Squame of second antennae reaching almost to end of third segment of second antennae.

Great chelae long and stout, propodus two and one-half times longer than broad, dactylus short and stout

QUINQUECARINATUS (Gray)

Four carinae on carapace.

Squame of second antennae long and slender.

Great chelae long and slender, propodus three times as long as broad,
dactylus long and slender

QUADRICARINATUS (von Martens)

Rostrum twice as long as broad at base, apex sharp.

Two carinae on carapace.

Squame of second antennae not broad anteriorly.

Sternal keel very sharp.

Great chelae long and stout, propodus two and one-half times as
long as broad, dactylus short and stout, with a tubercle in
centre of cutting edge BICARINATUS (Gray)

Great chelae slender, propodus two and one-half times as long as
broad, dactylus long and slender

s.sp. ANGUSTUS (McCulloch)

Rostrum twice as long as broad at base, apex sharp.

Two carinae on carapace.

Squame of second antennae very broad anteriorly.

Sternal keel moderately sharp, without conspicuous opening on
lateral processes DESTRUCTOR sp.nov.

Sternal keel blunt, with conspicuous openings on lateral processes

ALBIDUS sp.nov.

Rostrum slightly longer than broad at base, apex rounded.

Two carinae on carapace.

Sternal keel very sharp; lateral processes below second and third pereopods produced into conspicuous openings . PUNCTATUS sp.nov.

Cherax tenuimanus (Smith).

(Pl. IV, fig. 18.)

Chaeraps tenuimanus Smith, Proc. Zool. Soc. Lond., 1912, p. 166, pl. 22; 27, fig. 30.

Cheraps tenuimanus McCulloch, Rec. West. Austrl. Mus., i, pt. 3, 1914, p. 233, pls. 34, 35.

Length of average adult specimen, 375 mm.

Rostrum long and slender, four times as long as broad at base, reaching to, or beyond, end of third segment of second antennae, carinae sharp, each with from three to six spines; two carinae on carapace at outer side of rostral carinae, and one median carina.

Squame of second antennae long and slender, reaching well beyond the end of third segment of second antennae, terminal spine short and sharp. Interantennal spine short and broad, bluntly pointed.

Carapace shorter than abdomen, cervical suture deeply impressed, areola broad; branchiostegites covered with numerous small obtuse spines and tubercles, a row of sharp spines behind cervical suture. Anterior of carapace with numerous small tubercles, a row of obtuse spines reaching from interantennal spine to cervical suture. Entire carapace densely hirsute.

Sternal keel highly raised, broad and blunt, serrated into four large blunt tubercles, a sharp backwardly directed spine below great chelae. First three pairs of lateral processes obsolete, fourth pair large and flattened, shelf below

wide and sharp; processes between fourth pereopods short and stout, with a large blunt spine in centre of processes.

Abdomen densely punctate, lateral margins of first somite covered with numerous small blunt spines or tubercles, following somites each with a few small tubercles on lateral margins; entire abdomen more or less densely hirsute.

Telson with a spine on each lateral margin, and two or more median spines, at junction of membranous portion; inner rami of uropods each with a median spine and an outer lateral spine at junction of membranous portion; outer rami each with several sharp spines along transverse suture. Lobes at base of uropods with upper lobe produced into a long sharp spine.

Great chelae: these vary in size and stoutness in individuals of all sizes, length varying from two and one-half times to three and three-fourths times as long as broad; upper margin feebly serrated, without the setose margin usually found in species of *Cherax*, lower margin smooth, cutting edge of propodus and dactylus each with two or three small tubercles, smooth in some examples; apex of both sharply recurved. Carpus with one or two sharp spines on upper margin, upper surface deeply grooved. Merus with one or two small blunt tubercles on upper margin.

Habitat.—*Western Australia*: Margaret River (Miss H. Alexander, 1936); Harvey River; Korijekup; Kojonup; Balingup Brook; Warren River; Blackwood River; Katanning.

Popularly known as the Marron, fully-grown specimens equal in size the large Murray River Crayfish. The difference in the size of the great chelae in the sexes is striking in the 12 specimens examined, but in a large series it may not be a constant feature. Great variation is shown in the armature of the carapace and abdomen of immature and adult specimens.

Cherax quinquecarinatus (Gray).

(Pl. V, fig. 20.)

Astacus quinque-carinatus Gray, Eyre's Journ. Exped. Disc. Cent. Austrl., i (Appendix), 1845, p. 410, pl. 3, fig. 3.

Astacus quinquecarinatus Erichson, Arch. f. Naturg., xii, 1846, p. 376; White, List Crust. Brit. Mus., 1847, p. 72; von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 616.

Astacopsis quinque-carinatus Haswell, Cat. Austrl. Mus., Crust., p. 176, 1882.

Cheraps quinquecarinatus Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 677; Ortmann, Proc. Amer. Philos. Soc., xli, 1902, p. 291; Faxon, Mem. Mus. Comp. Zool., xl, 1914, p. 403; McCulloch, Rec. West. Austrl. Mus., i, pt. 3, 1914, p. 232, pl. 33.

Chaeraps quinquecarinatus Smith, Proc. Zool. Soc. Lond., 1912, p. 165.

Length of average adult specimen, 130 mm.

Rostrum long and slender, three times as long as broad at base, reaching to end of third segment of first antennae, apex sharp, with one or two spines at each side; carinae sharp, carried well back on to carapace; two carinae on carapace at outer side of rostral carinae, and one median carina.

Squame of each second antenna long and slender, reaching the end of

the third segment of second antennae, terminal spine short and sharp. Inter-antennal spine short and broad, sharply pointed.

Carapace shorter than abdomen, as high as broad, twice as long as broad; cervical groove deeply impressed, areola fairly broad; branchiostegites punctate, minutely tuberculate on some examples, a row of large tubercles behind cervical suture.

Sternal keel very sharp; first three pairs of lateral processes very small, posterior pair small and slightly grooved; processes between fourth pereopods short and stout.

Telson with a spine on each lateral margin at junction of membranous portion; inner rami of uropods each with a median spine and an outer lateral spine at junction of membranous portion; outer rami each with several sharp spines along transverse suture. Lobes at base of uropods with upper lobe produced into a long sharp spine.

Great chelae long and stout; propodus two and one-half times longer than broad, upper margin serrated, lower margin smooth; cutting edge of propodus and dactylus each with one or two small tubercles. Carpus with a small sharp spine on upper margin. Merus with one or two small blunt tubercles on upper margin.

Habitat.—*Western Australia*: Swan River (type locality); Perth (A. Blain, 1936); Northam, Avon River (E. Nelson, 1936); Chidlow's Wells; Cannington; Koriyekup; Harvey, Harvey River; Vasse River; Mundaring Weir; Toodyay.

Type in British Museum.

Popularly known as the Gilgy. Described from a series of 60 specimens received from Mr. A. Blain and Mr. E. Nelson.

Amongst the material from Perth is a fine example of a gynandromorph (Pl. IV, fig. 20c), a description of which is included here. Of the many hundreds of specimens examined during the progress of this paper it is the only such example, and is apparently the first to be definitely recorded from Australia.

Length, 110 mm.

Rostrum short and broad, reaching almost to end of first segment of first antennae, apex sharply upturned; carinae sharp, carried well back on to carapace, without spines; lateral carinae sharp, median carinae blunt.

Squame of the second antenna on the left side curved inwards instead of continuing straight to apex.

The carapace is broader in proportion to size than in the normal specimens, and the sternal keel much more raised and sharp. The external sexual organs of the male appear on the coxae of the fourth pereopod on the right side, and of the female on the second pereopod on the left side.

The great chela on the left side is large and stout, and that on the right small and slender.

Cherax quadricarinatus (von Martens).

(Pl. IV, fig. 19.)

Astacus quadricarinatus von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 617.

Astacopsis quadricarinatus Haswell, Cat. Austrl. Mus. Crust., 1882, 177.

Cheraps quadricarinatus Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 677; Ortmann, Proc. Amer. Philos. Soc., 1902, xli, p. 291; Calman, Ann. Mag. Nat. Hist., viii, 1911, p. 366; Faxon, Mem. Mus. Comp. Zool., xl, 1914, p. 403.

Chaeraps quadricarinatus Smith, Proc. Zool. Soc. Lond., 1912, p. 167.

Astaconephrops albertsii Nobili, Ann. Mus. Civ. Genova, xl, p. 244, 1899; Nobili, Boll. Mus. Zool. Torina, 1903, xviii, p. 1; Faxon, Mem. Mus. Comp. Zool., xl, 1914, p. 404.

Cheraps lorentzi Roux, Notes Leyden Mus., xxxiii, 1911, p. 97, figs. 4-5.

Cheraps aruanus Roux, Notes Leyden Mus., xxxiii, 1911, p. 88, figs. 2-3.

Astacopsis australasiensis Nobili, Ann. Mus. Civ. St. Nat., xl, 1899, p. 246; Boll. Mus. Zool. Torino, xviii, No. 445, 1903, p. 2.

Rostrum long and slender, three and one-half times as long as broad at base, apex long and sharp, with three spines at each side; carinae sharp, not reaching to apex, carried well back on to carapace, lateral carinae sharp.

Squame of each second antenna very long and slender. Interantennal spine short and broad, sharply pointed.

Carapace shorter than abdomen, as broad as high, areola very broad.

Sternal keel raised, moderately sharp; lateral processes obsolete, fourth pair flattened; a sharp backwardly directed spine in centre of obsolete lateral processes of fourth pereopods.

Membranous portion of telson short in comparison with upper calcareous portion, a spine on each lateral margin at posterior third. Uropods as long as telson, each divided by a longitudinal median carina ending in a spine at junction of membranous portion, a spine on outer lateral margin at membranous border; outer rami each divided by a feeble longitudinal median carina, numerous small sharp spines along transverse suture. Lobes at base of uropods with upper lobe produced to a small sharp spine.

Great chelae long and slender, propodus three times as long as broad, dactylus long and slender. Carpus with one to four small sharp spines on upper margin; upper margin of merus with two sharp spines.

Habitat.—*Queensland*: Cape York (type locality). *Northern Territory*: Adelaide River; Roper River (Sir B. Spencer). *New Guinea*: Katau; Mainikion; Sabang; Baie Etna; Mimika River. *Aru Islands*.

Cherax bicarinatus (Gray).

(Pl. V, figs. 21, 22.)

Astacus bicarinatus Gray, Eyre's Journ. Exped. Disc. Cent. Austrl., i (Appendix), p. 410, 1845.

Astacus bicarinatus Erichson, Arch. f. Naturg., xii, 1846, p. 376.

Astacopsis bicarinatus Haswell, Cat. Austrl. Mus., Crust., p. 177, 1882.

Chaeraps intermedius Smith, Proc. Zool. Soc. Lond., 1912, p. 168.

Cheraps preissii Er., McCulloch, Rec. West. Austrl. Mus., i, pt. 3, 1914, p. 229.

Length of average adult specimen, 140 mm.

Rostrum short and broad, reaching to base of third segment of first antennae, almost twice as long as broad at base, apex sharp with two blunt spines on each side; carinae smooth and blunt; lateral carinae blunt, ending in a rounded boss.

Squame of each second antenna fairly broad, sharply pointed, reaching to end of third segment of second antennae. Interantennal spine short and broad, sharply pointed.

Carapace shorter than abdomen, higher than broad, twice as long as broad; cervical groove deeply impressed, areola fairly broad; branchiostegites punctate, minutely tuberculate on some examples.

Sternal keel very sharp; a long sharp backwardly-directed spine below great chelae; first two pairs of lateral processes obsolete, third pair small and blunt, posterior pair larger, deeply grooved; processes between fourth pereopods long and stout.

Telson with a spine on each lateral margin at junction of membranous portion; inner rami of uropods each with a median spine and an outer lateral spine at junction of membranous portion; outer rami each with several sharp spines along transverse suture. Lobes at base of uropods with upper lobe produced into a long sharp spine.

Great chelae long and stout, propodus twice as long as broad, lower margin smooth, upper margin serrated; cutting edge smooth or with a few small tubercles; dactylus with one large tubercle in centre of cutting edge. Carpus with a large forwardly directed spine on upper margin. Merus with one or two small blunt tubercles on upper margin.

Habitat.—*Northern Territory*: Port Essington (type locality). *Western Australia*: Kojonup; Harvey, Harvey River; Guildford; streams outside Mammoth Cave, and inside the Calgardup Cave, Cave district (McCulloch); Hillman; Darkan; Korejikup; Toff's Pass, Stirling Range.

Types in British Museum.

Described from two specimens from Gray's type material, on loan from British Museum; compared with the two types of *C. intermedius* Smith in the National Museum; and seven specimens from Western Australia. Specimens from both Gray's and Smith's material are figured for comparison (Plate V).

Cherax bicarinatus s.sp. *angustus* (McCulloch).

Chaeraps preissi var. *angustus* McC., Rec. West. Austrl. Mus., i, pt. 3, p. 231.

"This variety differs from the typical form only in having more slender chelipeds and legs, and a slightly narrower carapace. The chelae are particularly narrow in my smallest specimens, and in this respect differ greatly from others of the typical form of about the same size in which they are almost similar to those of the adults. The colour, after long preservation, is a dark violet with light bluish areas on the sides and under parts.

"The plate illustrates the only three specimens I have seen, which were collected for the Australian Museum by Mr. A. Abjornssen, near Albany. They are 141, 102 and 78 mm. long from the tip of the rostrum to the end of the telson, and the largest and smallest are females" (McCulloch, op. cit.).

Smith (1912) erected a new genus *Parachaeraps* for a single species, *Astacus bicarinatus* Gray, which previously was included in the genus *Cheraps*. The reasons for erecting the genus are rather vague, as he states that *bicarinatus* does not differ very strikingly from species retained in *Cheraps*. The main reason, apparently, was to demonstrate his theory of the evolution of the Australian crayfishes, but in the paper with E. H. J. Schuster (1913) he refutes his original theory, introducing another in which this species is not important, making the genus no longer necessary from this point of view. Apart from that, the generic characters given do not apply to the specimens, now in the National Museum, upon which he founded the genus.

The chief generic character given is as follows:

"The distance between the tip of the rostrum and the cervical suture is *shorter* than between the cervical suture and the posterior border of the carapace."

While in *Chaeraps*:

"The distance between the tip of the rostrum and the cervical suture is distinctly *longer* than that between the cervical suture and the posterior border of the carapace."

Over four hundred specimens, including Smith's types, have been examined, and in all the distance between the tip of the rostrum and the cervical suture is at least one and one-third times as great as the distance between the cervical suture and the posterior border of the carapace.

Furthermore, the specimens on which *Parachaeraps* is based are not, as stated, *Astacus bicarinatus* Gray.

Gray (1845) described and figured *Astacus bicarinatus* from material collected at Port Essington, Northern Territory. Two pages preceding the description he gave an account of a drawing, received from Mr. Eyre, of a crayfish called by the natives eu-kod-ko or koon-go-la; he applied no name to this species, which he considered to be nearest his *quinquecarinatus*. Subsequent authors, however, have treated the drawing as synonymous with *A. bicarinatus*, although Faxon (1898, p. 673) noted that the description and figure do not apply very closely to the species commonly known by this name.

The types of *A. bicarinatus* received on loan from the British Museum show that Gray's species is identical with that described by Smith as *Chaeraps intermedius*. The common yabby (apparently the original of the drawing of the eu-kod-ko) on which Smith founded *Parachaeraps*, is distinct from *bicarinatus* and has not otherwise been named.

McCulloch (1914) placed *intermedius* as a synonym of *preissii* Erichson. Erichson (1846, p. 376) dealing with Gray's paper, states that the description of the telson would place *A. bicarinatus* in his subgenus *Cheraps*, but that the description of the head made it nearer *A. tasmanicus*. Therefore *bicarinatus* (or *intermedius*) apparently is not synonymous with *preissii*. Erichson's description of *preissii* is given for comparison.

Cherax preissii (Erichson).

Astacus (*Cheraps*) *preissii* Erichson, Archiv. f. Naturg., xii, 1846, p. 101.

Astacus preissii von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 617.

Astacopsis preissii Haswell, Cat. Austrl. Mus., Crust., 1882, p. 177.

Cheraps preissi Ortmann, Proc. Amer. Philos. Soc., xli, 1902, p. 291; Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 672.

Chacraps preissii Smith, Proc. Zool. Soc. Lond., p. 163, 1912.

"Etwas zusammengedrückt. Panzerschild punktirt, an den Seiten sehr fein gekörnt. Schnabel allmählich zugespitzt, glatt-randig, bis an das Ende des zweiten Gliedes der äusseren Fühler reichend. Die Fühlerblätter gross, eiförmig zugespitzt, fast bis zur Spitze des dritten Gliedes der äusseren Fühler reichend. Die Scheeren kräftig, nach innen und auf der Mitte einzeln, an der Aussenseite dicht und gröber punktirt, der Innenrand zu einer sägeförmig gezähnten Leiste erhoben; die Scheerenfinger stark mit hakiger Spitze. Das Glied vor der Scheere an der Innenseite mit einem Dorn. Die überstehenden Ecken der Schwanzschilder mit stumpfen etwas abgerundeten Winkeln.

"Länge von der Schnabelspitze bis zum Ende der Schwanzflosse 3" 5"', des Schnabels 3"', des Scheerenbeines 2" 3"', der Scheere 1", Breite der letzteren 5"', grösste Breite des Panzerschildes 9"', grösste Höhe desselben 10"."

"In dem südwestlichen Neuholland. Von Herrn Preiss eingesandt."

Cherax destructor sp. nov.

(Pl. I, figs. 3, 5; Pl. V, fig. 23.)

Astacoides bicarinatus McCoy, Prod. Zool. Vic., i, Dec. 3, p. 45, pl. 29, 1879.

Astacopsis bicarinatus Spencer and Hall, Rep. Horn Exped. Cent. Austrl., pt. ii, Zool., p. 244, 1896.

Cheraps bicarinatus Ortmann, Zoolog. Jahrb., Abth. f. Syst., vi, p. 7, pl. 1, fig. 2; Ortmann, Semon's Zoolog. Forsch. in Austrl., v, p. 21; Faxon, Proc. U.S. Nat. Mus., xx, p. 676, 1898; Ortmann, Proc. Amer. Philos. Soc., xli, p. 291, 1902.

Parachacraps bicarinatus Smith, Proc. Zool. Soc. Lond., 1912, p. 163; McCulloch, Rec. West. Austrl. Mus., i, pt. 3, 1914, p. 234; Raff, Proc. Roy. Soc. Vic., xxxi, p. 325, pl. 15, 1919; Hale, Austrl. Mus. Mag., ii, No. 8, 1925, p. 271; Hale, Handbook Crust. Sth. Austrl., p. 73, 1927.

Length of average adult specimen, 160 mm.

Rostrum twice as long as broad at base, reaching to base of third segment of first antennae, apex sharp, with a spine on each side; carinae blunt; lateral carinae blunt, ending in a rounded boss.

Squame of each second antenna very broad anteriorly, terminal spine short and sharp, reaching almost to end of third segment of second antennae. Interantennal spine short and broad, bluntly pointed; on some examples short, broad and rounded.

Carapace shorter than abdomen, broader than high, twice as long as broad; cervical groove deeply impressed, areola narrow; carapace punctate, branchiostegites minutely tuberculate.

Sternal keel moderately sharp, produced to a long, sharp, backwardly-directed spine below great chelae; first two pairs of lateral processes obsolete, third pair small and sharp, posterior pair small and very deeply grooved; processes between fourth pereopods short and stout.

Telson with a spine on each lateral margin at junction of membranous portion; inner rami of uropods each with a median spine and an outer lateral spine at junction of membranous portion; outer rami each with several sharp spines along transverse suture. Lobes at base of uropods with upper lobe produced to a small blunt spine.

Great chelae long and stout, propodus two and one-half times as long as broad, with numerous large punctures; upper margin formed by a row of large blunt tubercles, lower margin smooth, cutting edge of propodus and dactylus feebly serrated. Carpus with a small, blunt forwardly-directed spine on upper margin; merus with upper margin feebly serrated.

Colour.—The Hawthorn series shows the great variety of colours found in this species, the following being the colours of various examples: Light and dark green; dark green with blue pereopods and chelae; dark chocolate-brown; brown mottled with red; dark cream-buff mottled with red; pale pinkish on carapace and abdomen, with orange pereopods and chelae; light and dark slate-grey. These colours appear to be fairly general for all localities. Hale (1925-27) records almost black examples from Broken Hill, New South Wales.

Habitat.—*Victoria*: Melbourne (type locality); Fernshaw (W. Kershaw, 1879); Thorpdale (W. Kershaw, 1890); Muckleford Creek (F. L. Billingham, 1894); Pyramid Hill (E. H. Hennell, 1890); Warburton; Mortlake (S. W. Fulton, 1905); Castlemaine (T. S. Hall); Goulburn River; Chiltern (J. A. Kershaw, 1905); Lake Hattah (J. E. Dixon, 1917); Murchison (N. Lyons, 1935); Yea (J. and R. Drysdale, 1935); Somerville (B. Durrant, V. McConachy, 1936); Hawthorn (L. and R. Jones, T. Quigley, 1936); Dunolly (A. J. Williamson, 1930); Skipton (E. G. Austin, 1936). *South Australia*: Blanchetown No. 1 Lock (G. Brooks, 1935); Kapunda (H. I. Haines, 1935); Lucindale (A. M. Lea, 1914); Lower Light, via Two Wells (H. T. Donnelly, 1935); Happy Valley (P. H. Dodd, 1936); Myponga; Mosquito Creek, 8 miles south of Naracoorte (A. S. Dolan, 1935); Onkaparinga (F. R. Ball, 1936); Renmark No. 6 Lock (Kennewell, 1935); River Torrens (M. McAuna, 1936); Straun Creek, 9 miles south of Naracoorte (H. A. Lindsay, 1936); Yacka (C. Laube, 1935). *Central Australia*: Macumba River; Finke River; Stevenson River; Charlotte Waters; Running Waters; Hermannsburg (Sir Baldwin Spencer). *New South Wales*: Broken Hill (F. W. Shepherd, 1925); Manning River (Haswell, 1882); Mooki River (L. Weatherly, 1936). *Queensland*: Cape York; Rockhampton; Burnett River; Barron Falls (A. Tubb, 1935); Dunk Is. (D. A. Casey, 1936).

Types in the National Museum, Melbourne.

Over 400 specimens from all the above-mentioned localities were examined.

This species is extremely variable, particularly in the great chelae, interantennal spine and rostrum. In a series of two hundred specimens from a quarry hole at Hawthorn, Victoria, the great chelae vary in length and breadth at all stages of growth. Several examples, two inches long, have very short stout chelae with the dactylus less than half as long as the propodus; other examples of the same size have long, slender chelae, with the dactylus one-half as long as the propodus. Adult specimens, five and six inches long, show similar variations. The interantennal spine in some is short and broad, with a blunt point; in others short, broad and rounded; the outer margin may be serrated, or smooth. The rostrum varies greatly in breadth in examples of all sizes, the spines at the apex are obsolete in several specimens, and three have a spine on one side only of the apex.

Specimens from Barron Falls, Queensland, have the long, slender chelae and broad rostrum, identical with the Hawthorn examples. Specimens from Charlotte Waters, Central Australia, have no spines at the apex of the rostrum, but are otherwise identical with the type specimens.

Cherax albidus sp. nov.

(Pl. I, fig. 4; Pl. VI, fig. 24.)

Length of average adult specimen, 137 mm.

Rostrum twice as long as broad at base, reaching almost to base of third segment of first antennae; apex blunt, carinae blunt reaching almost to apex; lateral carinae blunt, ending in a rounded boss.

Squame of each second antenna broad anteriorly, terminal spine short and sharp, reaching to base of third segment of first antenna. Interantennal spine short and broad, sharply pointed.

Carapace shorter than abdomen, broader than high; areola fairly broad. Anterior of carapace smooth, posterior densely, minutely, punctate.

Sternal keel blunt, slightly rounded, produced to a sharp, backwardly-directed spine below great chelae; first two pairs of lateral processes obsolete, third pair small and flat, each with a conspicuous opening; posterior pair larger, slightly grooved, each with a conspicuous round opening on upper margin; processes between fourth pereopods flattened.

Telson with a spine on each lateral margin at junction of membranous portion; inner rami of uropods each with a median spine and an outer lateral spine at junction of membranous portion; outer rami each with several sharp spines along transverse suture. Lobes at base of uropods with upper lobe rounded.

Great chelae very long and stout; propodus three times as long as broad, with a few scattered punctures, upper margin with three feeble tubercles posteriorly, lower margin smooth, cutting edge with one small tubercle;

dactylus short and stout, upper margin smooth, cutting edge with two or three small tubercles. Carpus with a small, blunt, forwardly-directed spine on upper margin; upper margin of merus smooth. Upper margin of propodus and carpus, and cutting edge of propodus and dactylus densely covered with long setae.

Colour.—Carapace very pale olive-grey; abdomen light buff; underside and pereopods translucent white; joints of pereopods and great chelae vermilion; great chelae: ground colour light buff, suffused with light bluish-green.

Habitat.—*Victoria*: Nurrabiel, about 25 miles SW. of Horsham (type locality) (F. E. Hutchinson, 1935); Skipton (E. C. Austin, 1936). *New South Wales*: Berrigan (A. Hordern, 1935). *South Australia*: Angaston; Birdwood; Blackwood; Bordertown (L. Larwood, 1936); Gawler; Hamley Bridge; Koppio, near Todd River Reservoir (P. A. McDonald, 1936).

Types in the National Museum, Melbourne.

A series of 147 specimens from Victoria, 85 from South Australia, and 15 from New South Wales, was examined. Near *C. destructor*, but readily separated by the extremely large great chelae, and the sternal keel. This species is commonly known at Nurrabiel and Skipton as the White Yabby, to distinguish it from the common yabby, *C. destructor*, which is abundant in the same localities.

As in *C. destructor* there are numerous variations in the size and shape of the interantennal spine, rostrum and great chelae.

Cherax punctatus sp. nov.

(Pl. I, fig. 6; Pl. VI, fig. 25.)

Length of largest specimen examined, 121 mm.

Rostrum broadly cone-shaped, slightly longer than broad at base, apex rounded; carinae blunt, with two rows of punctures along each carina; lateral carinae each ending in a rounded boss, a row of deep punctures along each carina.

Squame of each second antenna rather short, reaching to base of second segment of first antenna, inner lobe moderately broad, terminal spine short and sharp. Interantennal spine slender, bell-shaped, surface concave.

Carapace shorter than abdomen, broader than high. Cervical groove deeply impressed, branchio-cardiac grooves obsolete, areola narrow. Entire carapace densely punctate; branchiostegites and anterior of carapace minutely tuberculate.

Abdomen densely punctate. Telson longer than broad, anterior calcareous, posterior from apical third membranous, a spine on each lateral margin at junction of membranous portion. Uropods half calcareous and half membranous, inner rami each with a longitudinal median carina ending in a short spine on membranous portion, a long sharp spine on outer lateral margin; numerous small blunt spines along transverse sutures of outer rami. Lobes at base of uropods without spines.

Sternal keel (Pl. I, fig. 6) narrow, raised and very sharp; first two pairs of lateral processes very small, third pair larger, with a conspicuous

round opening; posterior pair erect, each with a large round opening; processes between fourth pereopods obsolete.

Great chelae densely punctate; propodus stout, twice as long as broad, upper margin serrated, lower margin smooth, a narrow fringe of short hair on upper surface along upper margin, cutting edge smooth, apex curved; dactylus long and stout, apex curved, upper and lower margins smooth; a thick fringe of setae on underside of cutting edge of propodus and dactylus. Carpus with a longitudinal groove in middle of upper surface, upper margin with a double, forwardly-curved spine formed by a large and a small tubercle united at base; upper margin of merus serrated.

Habitat.—*Queensland*: Coorari (type locality) (Sir Baldwin Spencer, 1891); Eumundi (J. A. Kershaw).

Types in National Museum, Melbourne.

Described from 9 specimens, all of which were taken from burrows. This is the first species of burrowing crayfish to be described from Queensland. The habits are very similar to the various species of *Engaeus*, common in Victoria. They burrow down several feet to water level and build large cones at the entrances to the burrows. Two of the specimens collected by Mr. Kershaw were found under a rotten log. This is the first terrestrial species of *Cherax* to be described, although three species are taken in dams, quarry holes, etc.

Incertae Sedis.

Astacoides plebejus Hess.

Astacoides plebejus Hess, Arch. f. Naturg., xxxi, 1865, p. 164, pl. 7, fig. 17.

Astacus plebejus von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 617.

Astacopsis plebejus Haswell, Cat. Austrl. Mus., Crust., 1882, p. 177.

Cheraps preissi Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 676.

Astacopsis serratus Smith, Proc. Zool. Soc. Lond., 1912, p. 157.

“Der Cephalothorax ist fast glatt mit eingedrückten Punkten, das dreieckige Rostrum ist geneigt und läuft in eine Spitze aus. An der Basis desselben befindet sich beiderseits eine Erhöhung. Das erste Beinpaar ist lang und stark, der Arm lang dreieckig, der Carpus kurz, an der inneren Seite mit einem nach vorn gekrümmten Zahne. Die Hand ist verhältnissmässig gross, am unteren Seitenrande gezähnt. Der innere Rand des Zeigefingers trägt in der Mitte einen Tuberkel und ist am Ende abgestumpft. Der Daumen ist spitz und etwas gebogen und trägt ebenfalls in der Mitte des innenrandes einen Tuberkel. Die mittlere Schwanzflosse trägt in der Mitte beiderseits einen Zahn und ist am Ende bewimpert. Die seitlichen Schwanzflossen sind etwas kürzer ebenso bewimpert; die letzte ist nur an der äusseren Seite, die erste auch in der Mitte mit einem Zahne versehen.

“Länge 9, 4 Cm.

“Farbe gelblich, die Hände dunkel.

“Sydney (M. G.).”

The above description will not fit any of the hundreds of specimens examined. It is apparently a species of *Cherax*, judging by the figure. No mention is made in the text as to whether the telson and uropods are membranous. The figure shows the telson entirely calcareous, the inner rami of the uropods are divided by transverse sutures which may indicate the junction of membranous and calcareous portions, but the outer rami are apparently entirely calcareous, without transverse sutures. The great chelae also differ in the figure and the text.

Genus *GEOCHARAX* gen. nov.

Carapace higher than broad, punctate or tuberculate. Cervical groove deeply impressed, rounded.

Abdomen smooth, punctate, or setose; lateral margins rounded. First somite with lateral lobes small and rounded. Telson without transverse sutures, entirely calcareous.

Second antennae set at the side of the first, squame large. Upper lip short and broad, with a concave arch medianly.

Lateral processes of sternal keel obsolete, keel continued across posterior pair. Vas deferens on simple short papillae on coxae of fourth pereopods.

Stem of each podobranch laterally produced into a small wing-like expansion, bearing few hooked filaments. Gill formula $21 + epr$.

Genotype *Geocharax gracilis* sp. nov.

Key to Species of GEOCHARAX gen. nov.

Rostrum slender and sharp GRACILIS sp. nov.
Rostrum broad and blunt LYELLI sp. nov.

Geocharax gracilis sp. nov.

(Pl. I, fig. 8; Pl. VI, fig. 26.)

Length of average adult specimen, 55 mm.

Rostrum slender, reaching to end of third segment of first antennae, apex sharp and upturned; carinae very sharp, straight, carried well back on to carapace; lateral carinae very sharp, each ending in a rounded boss.

Second antennae slender, reaching to telson; squames large, reaching beyond the end of the third segment of first antennae, terminal spines short and sharp. Interantennal spine short and broad, pyriform, apex sharp. Eyes very large. Median arch of upper lip produced into two sharp, erect protuberances.

Carapace higher than broad, more than twice as long as broad, shorter than abdomen. Cervical suture deeply impressed, rounded; branchio-cardiac grooves obsolete, areola very broad. Entire carapace densely studded with minute tubercles.

Sternal keel narrow, sharp, continuous from great chelae across lateral processes of third pereopods; lateral processes obsolete, fourth pair small and flattened downwards; processes between fourth pereopods very short and stout.

Telson entirely calcareous, with a spine on each lateral margin at apical third; inner rami of uropods each divided by a longitudinal median carina reaching almost to posterior margin; outer rami each divided by two longitudinal median carinae, transverse suture placed at apical third, several small sharp spines along suture. Lobes at base of uropods with lower lobe produced to a small spine.

Pereopods very slender, especially fourth pair. Great chelae short and slender; propodus more than twice as long as broad, punctate, upper margin serrated, lower margin smooth; apex sharp and incurved, cutting edge with one large tubercle; dactylus one-half as long as propodus, stout, upper margin smooth, sharply curved on cutting edge, apex sharp and incurved. Carpus densely punctate, upper margin serrated; upper margin of merus serrated.

Habitat.—*Victoria*: Gellibrand River, south of Colac (type locality) (W. H. F. Hill); Portland (L. R. Kurtze, 1935). *Kangaroo Island* (Sth. Aust. Museum, 1936).

Types in National Museum, Melbourne.

A well-graduated series of 68 specimens examined.

Geocharax lyelli sp. nov.

(Text fig. 1.)

Length of largest specimen, 62 mm.

Rostrum broad, reaching to base of second segment of first antennae, apex blunt; carinae sharp, straight, carried well back on to carapace; lateral carinae obsolete.

Second antennae slender, reaching to base of telson; squame large, very broad anteriorly, terminal spine short and sharp. Interantennal spine short and broad, apex sharp. Eyes small. Median arch of upper lip smooth.

Carapace higher than broad, more than twice as long as broad, shorter than abdomen. Cervical suture deeply impressed, rounded; branchio-cardiac grooves obsolete, areola broad. Entire carapace studded with minute tubercles.

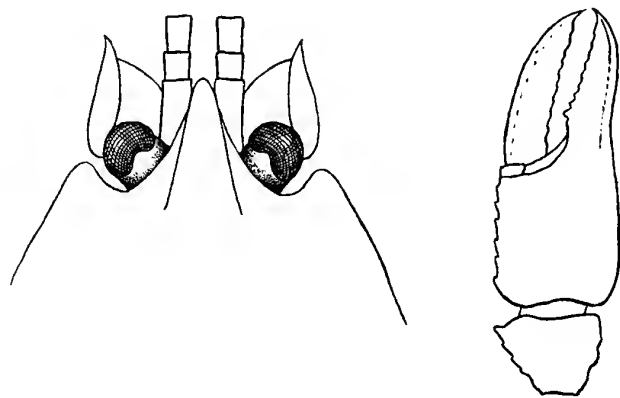


FIG. 1. *GEOCHARAX LYELLI* sp. nov.

Sternal keel of male blunt, high and swollen between second and third pereopods, first three pairs of lateral processes obsolete, fourth pair each with a large opening on lateral surface; processes between fourth pereopods very short and stout. Sternal keel of female slender and sharp between second and third pereopods and the openings on the fourth pair of lateral processes much larger than in male.

Telson entirely calcareous, with a spine on lateral margins at apical third; inner rami of uropods each divided by a longitudinal median carina reaching almost to posterior margin; outer rami each divided by two longitudinal median carinae, transverse suture placed at apical third, several small sharp spines along suture. Lobes at base of uropods rounded.

Pereopods slender. Great chelae short and slender, propodus twice as long as broad, upper margin serrated, lower margin smooth; apex sharp and incurved, cutting edge usually formed by a row of small tubercles, with one larger tubercle about posterior third; dactylus one-half as long as propodus, stout, upper margin smooth, lower margin with a few small tubercles, apex sharp and incurved. Upper margins of both carpus and merus serrated.

Habitat.—*Victoria*: Gisborne (G. Lyell, 1936).

Described from 2 males and 1 female. Readily separated from *G. gracilis* by the rostrum and the sternal keel.

Genus *ASTACOPSIS* Huxley.

Proc. Zool. Soc. Lond., 1878, p. 764.

Astacus Gray, Eyre's Journ. Exped. Disc. Centrl. Austrl., i (Appendix), p. 409, 1845; von Martens, Monatsber. Akad. Wiss. Berlin, 1868, p. 615.

Astacopsis Smith, Trans. Linn. Soc. Lond., ser. 3, xi, 1908, Zool., p. 70; Haswell, Cat. Austrl. Mus., Crust., 1882, p. 175; Smith, Proc. Zool. Soc. Lond., 1912, p. 154; Faxon, Proc. U.S. Nat. Mus., xx, 1898, p. 669; Faxon, Mem. Mus. Comp. Zool., xl, 8, p. 402, 1914.

Carapace with numerous small tubercles and punctures. Rostrum broad, carinae blunt, tuberculated. Cervical groove deeply impressed, rounded.

Abdomen smooth or punctate, lateral margins pointed, usually with spines on lateral margins only of first and second somites. First somite with lateral lobes large and rounded. Telson and uropods calcareous, except at posterior margin; telson without a transverse suture.

Second antennae set at the side of the first, squames large. Upper lip long and narrow, straight or somewhat concave medianly.

Sternal keel raised, blunt or moderately sharp.

Vas deferens on simple short papillae on coxae of fourth pereopods.

Stems of podobranchs (Pl. I, fig. 2) without broad wing-like expansions.

Gill formula 21 + epr.

Key to Species of ASTACOPSIS Huxley.

Squame serrated FRANKLINII (Gray)

Squame smooth.

Rostrum divided by a longitudinal median carina . . . GOULDI sp. nov.

Rostral carinae produced to sharp points . . . TRICORNIS sp. nov.

Astacopsis franklinii (Gray).

(Pl. VII, fig. 27.)

Astacus franklinii Gray, Eyre's Journ. Exped. Disc. Cent. Austrl., i (Appendix), p. 409, t. 3, f. 1.

Astacus franklinii Erichson, Arch. f. Naturg., xii, 1846, p. 375; White, List Crust., Brit. Mus., p. 72; von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 616.

Astacopsis franklinii Haswell, Cat. Austrl. Mus., Crust., p. 176, 1882; Thomson, Papers and Proc. Roy. Soc. Tas., 1892, p. 50; Faxon, Proc. U.S. Nat. Mus., xx, p. 669, 1898; Ortmann, Proc. Amer. Philos. Soc., xli, p. 292, 1902; Faxon, Mem. Mus. Comp. Zool., xl, 8, p. 402.

Length of largest specimen examined, 100 mm.

Rostrum broadly cone-shaped, almost as long as broad at base, apex blunt; carinae blunt, with six or seven small round tubercles; surface of rostrum with numerous large, deep punctures; a small tubercle at base of lateral carinae.

Eyes large. Outer antennae slender, reaching to third abdominal segment, squame with three to five small sharp spines on outer margin, terminal spine stout and blunt, inner lobe broad. Interantennal spine long and broad, sharply pointed, lateral margins serrated.

Carapace shorter than abdomen, as high as broad, slightly more than twice as long as broad; cervical groove deeply impressed, branchio-cardiac grooves obsolete; branchiostegites and anterior of carapace minutely tuberculate.

Sternal keel blunt; first two pairs of lateral processes small and sharp, third pair larger, blunt and slightly grooved, posterior pair large, blunt and deeply grooved; processes between fourth pereopods short and stout.

First segment of abdomen with a small sharp spine on each lateral lobe; second segment with four small sharp spines along lateral margins; lateral margins of second to sixth abdominal segments each produced to a small spine; no other spines or prominences on abdomen. Telson slightly longer than broad, without trace of transverse suture, a small spine on each lateral margin near posterior margin; uropods as long as telson, each divided by a feeble longitudinal median carina, ending in a spine almost on posterior margin; inner rami with a small spine on lateral margin near posterior margin; transverse suture of outer rami fringed by several small sharp spines; semi-membranous below transverse suture. Lobes at base of uropods without spines.

Great chelae short and stout; propodus twice as long as broad, with numerous small tubercles and deep punctures, upper margin with a single row of blunt tubercles, lower margin with a double row of small blunt tubercles, cutting edge with five small tubercles, margined on the outer side by a row of seven or eight small blunt tubercles; dactylus stout, cutting edge with three large and four small tubercles, margined on the outer side by a row of seven or eight small blunt tubercles; upper margin with two longitudinal carinae, each with five or six small round tubercles; carpus with one large and four or five small sharp spines on upper margin; merus with a row of very small sharp spines on upper margin.

Habitat.—*Tasmania*: Saundridge (A. Bartholomew); Hobart (V. Hickman).

Types in the British Museum.

Described from six specimens, all of which were dug out of burrows in swampy ground. The serrated squame readily distinguishes this species from others of the genus.

Drawings of specimens examined were compared with the types in the British Museum (see notes on *A. gouldi* sp. nov.).

Astacopsis gouldi sp. nov.

(Pl. VII, fig. 28.)

Astacus sp. Gould, Papers and Proc. Roy. Soc. Tas., p. 42, 1870.

Astacopsis franklinii Huxley, Proc. Zool. Soc. Lond., 1878, p. 764; Smith, Trans. Linn. Soc. Lond., sec. ser., xi, Zool., p. 70, 1908; Smith, *A Naturalist in Tasmania*, p. 110, fig. 30, 1909; Smith, Proc. Zool. Soc. Lond., p. 154, 1912.

Length of average adult specimen, 375 mm.

Rostrum broad, apex sharp, almost as broad as long at base; carinae rounded, with three blunt spines on each side; a sharp longitudinal carina in centre of rostrum continued backward from apex about half-way to base; a blunt spine at base of rostral carinae, with a large rounded boss posterior-laterally to it.

Eyes large. Squame of each second antenna smooth, as broad as long, inner lobe rounding gradually to a short blunt spine. Interantennal spine rather long and narrow, sharply pointed, lateral margins either smooth or serrated.

Carapace longer than abdomen; twice as long as broad, broader than high; branchiostegites with a few small scattered tubercles and punctures.

Sternal keel moderately sharp, with a long, sharp, backwardly-directed spine below first pereopods; lateral processes large and sharp, largest below great chelae, posterior pair deeply grooved.

First segment of abdomen with a spine on each lateral lobe; second segment with five spines on each lateral margin, remaining segments with lateral margins each produced to a small spine. Telson as long as broad at base, without trace of transverse suture, with a spine on each posterior-lateral margin; inner rami of uropods each with a median posterior spine and a lateral spine; outer rami each with eight or nine spines along transverse suture; lobes at base of uropods with a spine on each upper lobe.

Great chelae very stout; propodus two and one-half times as long as broad, upper margin with three large tubercles, lower margin with one or two rows of spines or tubercles, one large and several small tubercles on cutting edge; dactylus with one large and several smaller tubercles on cutting edge, upper margin with three or four small tubercles; apex densely tuberculate; carpus with a long sharp spine and a short blunt spine on upper margin; merus with five or six small spines on upper margin.

Habitat.—*Tasmania*: Circular Head (type locality) (J. Leadbeater); Zeehan; Mt. Wellington; Gordon River; Brid and Muddy Creeks, Bridport; Macquarie Harbour;

Types in the National Museum, Melbourne.

Generally identified by previous workers as *A. franklinii* Gray, this species differs considerably, particularly in the armature of the squame of the second antennae and the carpus

of the great chelae. *A. franklinii* is represented in the National Museum collections by six specimens, the largest measuring 100 mm. from tip of rostrum to end of telson. Gray does not give the size of his types. Drawings of *A. franklinii* and *A. gouldi* were sent to Dr. Isabella Gordon at the British Museum for comparison with Gray's types, and in her notes on *franklinii*, accompanied by sketches, Dr. Gordon writes that the larger of the two type specimens is complete and measures just under five inches from tip of chela to end of telson. The smaller specimen is damaged.

Gould (1870) gave an account of the habits and distribution of this species, and remarked on the fact that, in spite of its great size and the ease with which it is captured, it did not appear to be named.

Astacopsis tricornis sp. nov.

(Pl. I, fig. 7; Pl. VII, fig. 29.)

Length of largest specimen examined, 105 mm.

Rostrum narrow, one and one-half times as long as broad at base; carinae blunt, with three or four tubercles; apex of rostrum and carinae each produced into a long bluntly-pointed spine; a small tubercle present at base of carinae, with a large rounded boss posterior-laterally.

Eyes large. Squame of each second antenna smooth, reaching to end of third segment of first antennae, broad and sharply pointed. Interantennal spine short and broad, apex long and sharp, surface concave, lateral margins serrated.

Carapace shorter than abdomen, as high as broad, slightly more than twice as long as broad; cervical groove deeply impressed, branchio-cardiac grooves feeble, areola broad. Branchiostegites and anterior of carapace with several, scattered small tubercles; otherwise smooth.

Sternal keel (Pl. I, fig. 7) blunt; lateral processes erect, slender and sharp, posterior pair deeply grooved; a large deep opening under lateral processes, largest on third and fourth pairs; process between fourth pereopods long and stout.

First abdominal segment with a small spine on each lateral lobe; second segment with four small spines along each lateral margin; lateral margins of all following segments each produced to points. A row of small blunt tubercles on dorso-lateral margins of each segment; abdomen otherwise smooth. Telson slightly longer than broad, without trace of transverse suture, with a spine on each lateral margin near posterior margin. Uropods rounded, as long as telson, inner rami each divided by a feeble longitudinal median carina ending in a blunt spine near posterior margin; outer rami each with transverse suture at apical third, one large and several small spines along suture; lobes at base of uropods rounded, without spines.

Great chelae: propodus two and one-half times as long as broad, upper and lower surface with a few scattered punctures; upper margin with six sharp spines, lower margin with a double row of small sharp spines, cutting edge with three small tubercles; dactylus with a double row of small blunt spines on upper margin, and two small tubercles on cutting edge; one large

sharp spine and a small blunt spine on upper margin of carpus; merus with one large and four small sharp spines on upper margin.

Habitat.—*Tasmania*: Lake St. Clair (type locality) (Spencer, 1893); Cradle Mountain.

Types in the National Museum, Melbourne.

This species was identified by Smith as *A. franklinii* var. *tasmanicus* Er., and is mentioned in his notes on that species. As shown elsewhere in this paper *tasmanicus* Erichson is not an *Astacopsis*. *A. tricornis* differs from other species of the genus in having the rostral carinae produced into long blunt spines, giving the impression of a pair of horns; also by the openings under the lateral processes of the sternal keel.

Five specimens examined.

Genus ENGAEUS Erichson.

Astacus (Engaeus) Erichson, Arch. f. Naturg., xii, 1846, p. 102.

Astacus von Martens, Monats. Akad. Wiss. Berlin, p. 618, 1868.

Engaeus Huxley, Proc. Zool. Soc. Lond., p. 769, 1878; Haswell, Cat. Austrl. Mus., Crust., p. 178, 1882; Faxon, Proc. U.S. Nat. Mus., xx, p. 670, 1898; Faxon, Mem. Mus. Comp. Zool., xl, 8, p. 403, 1914; Smith and Schuster, Proc. Zool. Soc. Lond., 1913, p. 118.

Carapace higher than broad, punctate or feebly tuberculate, cervical groove either feeble or moderately well impressed, somewhat "V" shaped. Rostral carinae smooth or feebly tuberculate.

Abdomen smooth, punctate, or setose; lateral margins rounded. First somite without lateral lobes. Telson without transverse sutures, entirely calcareous.

Second antennae set under the first; squames small. Upper lip short and broad, and more or less highly arched medianly.

Sternal keel narrow, posterior pair of lateral processes large and deeply grooved. Vas deferens on simple short papillae on coxae of fourth pereopods.

Stems of podobranchs without wing-like expansions. Posterior pleurobranchs usually well developed, sometimes rudimentary. Gill formula 21 + epr.

Genotype *Astacus (Engaeus) fossor* Erichson.

Key to Species of ENGAEUS Erichson.

Abdomen longer than carapace. Sternal keel without openings on lateral processes.

Cervical groove moderately impressed, areola broad.

Uropods rounded.

Great chelae slender, a row of feeble tubercles on upper margin, lower margin smooth CUNICULARIUS Erich.

Abdomen as long as carapace. Sternal keel with openings on lateral processes.

Cervical groove deeply impressed; areola fairly broad. Uropods pointed.

Great chelae with a row of tubercles on upper, lower and posterior margins PHYLLOCERCUS Sm. and Sch.

- Cervical groove feebly impressed, areola fairly broad. Uropods rounded.
Great chelae slender, a row of feeble tubercles on upper margin, lower margin smooth; under surface with a covering of downy hair
SERICATUS sp. nov.
- Great chelae stout, a single row of tubercles on upper margin, lower margin with a smooth ridge QUADRIMANUS sp. nov.
- Great chelae stout, a double row of tubercles on upper margin, and a single row on lower margin FOSSOR Erich.
- Abdomen shorter than carapace. Sternal keel without openings on lateral processes.
- Cervical groove deeply impressed.
Areola broad; inner rami of uropods rectangular, transverse sutures strong TUBERCULATUS sp. nov.
- Areola narrow; uropods rounded, transverse sutures strong
VICTORIENSIS Sm. and Sch.
- Cervical groove obsolete, branchio-cardiac grooves deeply impressed, areola fairly broad.
- Carapace, abdomen and chelae densely hirsute VILLOSUS sp. nov.
- Cervical groove and branchio-cardiac grooves obsolete, areola fairly broad.
Uropods rounded, transverse sutures feeble AFFINIS Sm. and Sch.

Engaeus cunicularius Erichson.

(Pl. VIII, fig. 35.)

Astacus (Engaeus) cunicularius Erichson, Arch. f. Naturg., xii, 1846, p. 102.

Astacus cunicularius von Martens, Monats. Akad. Wiss. Berlin, p. 169, 1868.

Engaeus cunicularius Haswell, Cat. Austrl. Mus., Crust., 1882, p. 179, Thomson, Papers and Proc. Roy. Soc. Tas., p. 50, pl. 1, figs. 1-2, 1892; Faxon, Proc. U.S. Nat. Mus., xx, p. 676, 1898; Ortmann, Proc. Amer. Phil. Soc., xli, p. 292, 1902; Smith and Schuster, Proc. Zool. Soc. Lond., p. 124, 1913; Faxon, Mem. Mus. Comp. Zool., xl, 8, p. 403, 1914.

Length of average adult specimen, 60 mm.

Rostrum broad, reaching to base of third segment of first antennae, apex blunt, slightly upturned; carinae sharp, carried well back on to carapace.

Eyes large. First antennae with inner flagella slender, seven-eighths as long as outer. Squame of each second antenna with a sharp terminal spine, inner lobe broad posteriorly. Interantennal spine elongated, triangular, bluntly pointed. Exopods of third maxillipedes long and slender.

Carapace punctate, shorter than abdomen, cervical groove and branchio-cardiac grooves deeply impressed, areola broad. Branchiostegites minutely tuberculate.

Sternal keel narrow, very sharp; first three pairs of lateral processes rudimentary; posterior pair large, slightly grooved; processes between fourth pereopods small and stout.

Telson rounded, a spine on lateral margins near posterior margin; uropods rounded, longer than telson, each with a longitudinal median carina ending in a spine almost on posterior margin; inner rami each with a spine on outer

lateral margins; outer rami each with four or five sharp spines along transverse suture.

Great chelae slender, propodus twice as long as broad, feebly tuberculate on upper margin, lower margin smooth; dactylus straight, inner margin smooth or feebly tuberculate; cutting edge of propodus feebly tuberculate, or with a large compound tubercle; upper margin of carpus and merus smooth or feebly serrated.

Posterior pleurobranch long and well developed.

Habitat.—*Tasmania*: Glenore, near Hageley (A. Bartholomew, 1889); Launceston (A. Bartholomew, 1889); Mundan Farm, Longford (A. Bartholomew, 1889).

Types in the Berlin Museum.

Nineteen specimens from various localities were examined.

Engaeus phyllocercus Smith and Schuster.

(Pl. VIII, fig. 33.)

Engaeus phyllocercus Sm. and Sch., Proc. Zool. Soc. Lond., 1913, p. 122.

Length of average adult specimen, 60 mm.

Rostrum broad, reaching to base of third segment of first antennae, apex sharp and upturned; carinae sharp, carried well back on to carapace, anteriorly reaching apex.

Eyes small. First antennae with inner flagella two-thirds as long as outer, slender. Squamulae of each second antenna very slender, ending in a short sharp spine. Interantennal spine broad, rounded or bluntly pointed. Exopods of third maxillipedes rudimentary or in the form of a short papilla, in some examples exopods absent.

Carapace punctate, as long as abdomen, cervical groove and branchio-cardiac grooves deeply impressed, arcuate fairly broad. Branchiostegites minutely tuberculate.

Sternal keel moderately sharp; first three pairs of lateral processes small and sharp, posterior pair rounded, deeply grooved; processes between fourth pereopods slender, not joined above, on some examples stout and joined above.

Telson cone-shaped, with a spine on each posterior lateral margin; inner rami of uropods slender, longer than telson, each divided by a longitudinal median carina ending in a long sharp point beyond posterior margin, a sharp spine on outer lateral margin; outer rami each with a longitudinal median carina ending in a blunt point on posterior margin, transverse suture placed at apical third, five or six small sharp spines along suture.

Great chelae punctate; propodus stout, twice as long as broad, margined by a row of large tubercles on upper surface, dactylus and anterior of propodus long and slender, each with one tooth on cutting edge; carpus and merus each with a row of tubercles on upper margin.

Posterior pleurobranch rudimentary; in some examples well developed.

Colour.—General colouring orange-scarlet; telson, lateral margins of carapace and abdomen light yellowish-brown. Great chelae: upper surface deep orange-scarlet, yellowish-brown on under surface, carpus and merus shading to brown.

Habitat.—*Victoria*: Narracan (W. Kershaw, 1889); Thorpdale (W.

Kershaw, 1890); Trafalgar (J. A. Kershaw, 1888); Warragul (W. Kershaw, 1887); Mt. Eccles (C. E. Summers, 1929); Wilson's Promontory (A. Clavarine, 1906); Warburton (F. J. Williams, 1871).

Types in the National Museum, Melbourne.

Smith and Schuster state that "All pleurobranchs are of approximately equal size, the last one not being reduced." Over 30 specimens, including the types, have been examined, and only six specimens have the posterior pleurobranch well developed, all the others having only a rudimentary pleurobranch. The species is very variable, particularly in the length of the exopod of the third maxilliped and the sharpness of the sternal keel.

Engaeus sericatus sp. nov.

(Pl. VIII, fig. 34.)

Length of average adult specimen, 60 mm.

Rostrum broad, reaching base of third segment of first antennae, apex blunt and straight; in some examples apex sharp and upturned; carinae sharp, not reaching apex.

Eyes small. First antennae with inner flagella three-fourths as long as outer. Outer antennae reaching third segment of abdomen, squame short and broad, terminal spine long and sharp. Interantennal spine triangular, sharply pointed, surface convex. Exopods of third maxillipedes long and slender; maxillipedes, exopods, and all the mouth-parts with a thick covering of soft downy setae.

Carapace as long as abdomen, cervical groove and branchio-cardiac grooves obsolete, areola fairly broad; branchiostegites and anterior of carapace with numerous minute tubercles.

Sternal keel raised and sharp; first two pairs of lateral processes small, third pair larger and sharp, posterior pair blunt, slightly grooved; processes between fourth pereopods short and stout, not joined above; a conspicuous round opening present on each lateral process.

Telson broadly cone-shaped with a spine on each posterior-lateral margin; uropods rounded, same length as telson, inner rami each with a longitudinal median carina ending in a spine almost on posterior margin, outer lateral margin with a spine at posterior margin; outer rami each with a longitudinal median carina, transverse suture fringed by several small spines, suture placed at apical third.

Great chelae: propodus slender, two and one-half times as long as broad, upper surface smooth, under surface with a covering of soft downy setae; upper margin feebly serrated, lower margin smooth, cutting edge with one large and a few small tubercles; cutting edge of dactylus with a large compound tubercle; some examples with two or three simple tubercles near compound one; upper margin of carpus and merus feebly serrated.

Habitat.—*Victoria*: Croydon (type locality) (S. W. Fulton); Mortlake; Warragul; Warburton; Matlock.

Types in the National Museum, Melbourne.

This species is characterized by the thick covering of downy

setae on the under surface of the great chelae, on the third maxillipedes, and on all the mouth parts.

Thirty specimens from the above localities examined.

Engaeus quadrimanus sp. nov.

(Pl. VIII, fig. 32.)

Length of average adult specimen, 80 mm.

Rostrum reaching almost to base of third segment of first antennae, apex blunt and straight; carinae blunt, reaching to apex.

Eyes large. First antennae with inner flagella seven-eighths as long as outer. Squame of each second antenna broad, terminal spine long and sharp. Interantennal spine long, broadly triangular, sharply pointed. Exopods of third maxillipedes long, fully developed.

Carapace as long as abdomen, cervical groove feebly impressed laterally, deeply impressed posteriorly, branchio-cardiac grooves feeble, areola narrow. Branchiostegites and anterior of carapace tuberculate.

Sternal keel raised and sharp; first two pairs of lateral processes small and blunt, third pair sharp, posterior pair fairly large, blunt and deeply grooved; each of the lateral processes with a small but conspicuous round opening, largest on third pair; processes between fourth pereopods long and stout, not joined above.

Telson broadly cone-shaped with a spine on posterior-lateral margins; uropods large and rounded, as long as telson, inner rami each with a longitudinal median carina ending in a spine almost on posterior margin, outer lateral margin with a spine near posterior margin; outer rami each with a longitudinal median carina, transverse suture placed at apical third, several small sharp spines along suture.

Great chelae minutely tuberculate; propodus stout, twice as long as broad, upper margin with a single row of large tubercles, lower margin with a smooth carina, cutting edge with two or three large and several small tubercles; dactylus with a large compound tubercle and a few small simple tubercles on cutting edge, upper margin with a smooth carina; carpus and merus each with a row of small tubercles on upper margin.

Posterior pleurobranch long, well developed.

Colour.—In general appearance dark olive-green shading into light green on telson and lateral margins of carapace and abdomen. Dactylus and anterior of propodus, upper and posterior margins of propodus, carpus and merus dark olive-green; remainder of chelae shading from light green to cream-buff.

Habitat.—*Victoria*: Warragul (type locality) (W. Kershaw, 1888); Lakes Entrance (W. Kershaw, 1887); Derby River, Wilson's Promontory (J. A. Kershaw, 1905); Ferntree Gully (S. W. Fulton, 1906); Croydon (S. W. Fulton, 1907); Mt. Dandenong (S. W. Fulton, 1910); Warburton (F. J. Williams, 1871); Skipton (C. E. Austin, 1935); King Island (G. Mack, 1935).

Types in the National Museum, Melbourne.

Widely distributed throughout Victoria, south of the Main Divide. This species was described and figured by Smith and Schuster (1913) as *E. cunicularius* Er., but is readily distin-

guished by the form of the great chelae and the sternal keel; *E. cunicularius* appears to be confined to Tasmania. Specimens from King Island differ from the mainland form in having the great chelae and pereopods covered by long, stout setae, but there are no other characters to separate the two forms.

Forty-two specimens examined.

Engaeus fossor Erichson.

(Pl. I, fig. 9; Pl. VIII, fig. 31.)

Astacus (Engaeus) fossor Erichson, Arch. f. Naturg, xii, 1846, p. 102.

Astacus fossor von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 618.

Engaeus fossor Haswell, Cat. Austrl. Mus., Crust., p. 178, 1882; Faxon, Proc. U.S. Nat. Mus., xx, p. 676, 1898; Ortmann, Proc. Amer. Phil. Soc., xli, p. 292, 1902; Smith and Schuster, Proc. Zool. Soc. Lond., 1913, p. 119; Faxon, Mem. Mus. Comp. Zool., xl, 8, p. 403, 1914; Clark, Vict. Nat., liii, 1936, p. 66, fig. 2.

Engaeus fultoni Smith and Schuster, Proc. Zool. Soc. Lond., 1913, p. 126.

Length of average adult specimen, 55 mm.

Rostrum narrow, apex blunt; carinae sharp, carried well back on to carapace.

Eyes large. Inner flagella of first antennae seven-eighths as long as outer. Squame of each second antenna small, bluntly pointed, inner lobe narrow. Interantennal spine short and narrow, bluntly pointed. Exopod of each third maxillipede usually long and slender, on some examples indicated by a small papilla.

Carapace punctate, as long as abdomen; cervical groove and branchio-cardiac grooves feebly impressed, areola broad.

Sternal keel (Pl. I, fig. 9) raised and very sharp; first two pairs of lateral processes small, third pair larger and sharp, posterior pair small and blunt, slightly grooved; a conspicuous opening present on each lateral process; processes between fourth pereopods long and stout, not joined above.

Telson narrowly cone-shaped, with a spine on lateral margins; uropods rounded, with a longitudinal median carina ending in a sharp spine almost on posterior margin, inner rami each with a spine on outer lateral margin; outer rami each with several small spines along transverse suture.

Great chelae punctate; propodus one and one-half times longer than broad; two rows of large tubercles on upper margin, lower margin with a single row of tubercles; dactylus curved, with one tubercle on cutting edge, upper margin with three longitudinal grooves reaching from apex to base; cutting edge of propodus with three tubercles, margined by a smooth carina, lower margin with a distinct carina; carpus and merus each with a row of tubercles on upper margin.

Posterior pleurobranch well developed.

Habitat.—*Tasmania*: Smithton (R. H. Champion, 1935); Clayton Rivulet (E. Scott, 1934); Pioneer Mine, Derby; Muddy Creek, Bridport. *Victoria*: Otway Ranges (W. Groves, 1934); Ferntree Gully.

Types in Berlin Museum.

A series of 24 specimens from the Otway Ranges and the type specimens of *fultoni* have been examined and compared with specimens from various localities in Tasmania. There is no character on which to separate them.

Engaeus tuberculatus sp. nov.

(Pl. IX, fig. 39.)

Length of average adult specimen, 70 mm.

Rostrum long and slender, apex upturned, long and sharp; carinae sharp, half as long as rostrum, with three small tubercles at anterior end.

Eyes large. First antennae with inner flagella very short and slender, about one-fifth as long as outer. Squame of each second antenna slender, ending in a long sharp spine. Interantennal spine short and broad, bluntly pointed, laterally produced at base. No exopod on third maxillipedes.

Carapace longer than abdomen; cervical groove and branchio-cardiac grooves well defined, areola fairly broad. Branchiostegites and anterior of carapace minutely tuberculate.

Abdomen with small tubercle-like swellings, rather low and flattened, with a puncture on summit; two rows on each segment. Telson broadly cone-shaped, without median or lateral spines; inner rami of uropods rectangular, inner corners sharp and outer rounded, each divided by a longitudinal median carina reaching to posterior margin, without median or lateral spines; outer rami each divided by a longitudinal median carina ending in a sharp spine on transverse suture, two or three spines along suture, suture placed at apical third of uropods.

Sternal keel raised and fairly sharp; first two pairs of lateral processes rudimentary, small but sharp below second pereopods, larger and rounded below third pereopods, deeply grooved; processes between fourth pereopods short and stout.

Great chelae long and stout; propodus stout, twice as long as broad, bordered on upper, lower and posterior margins by a double row of small tubercles, cutting edge with one compound and three or four simple large tubercles, a smooth carina reaches from apex to base of upper surface of dactylus; dactylus with two large tubercles on cutting edge, upper margin divided by a smooth carina, several small tubercles and punctures on upper margin; carpus with upper surface covered by six or seven rows of small tubercles; merus with a row of small tubercles on upper margin.

Posterior pleurobranch rudimentary.

Habitat.—*Victoria*: Sherbrook Falls (N. J. Favalora); Dandenong (S. W. Fulton); Warburton (S. W. Fulton).

Types in the National Museum, Melbourne.

Forty-three specimens examined.

Engaeus victoriensis Smith and Schuster.

(Pl. IX, fig. 38.)

Engaeus victoriensis Sm. and Sch., Proc. Zool. Soc. Lond., 1913, p. 121;

Clark, Vict. Nat., liii, 1936, p. 66, fig. 1.

Length of average adult specimen, 60 mm.

Rostrum slender, reaching to base of third segment of first antennae, apex

upturned; carinae blunt, reaching almost to apex; in some examples rostrum fairly broad, reaching to end of third segment of first antennae, carinae blunt, reaching almost to apex.

Eyes small. First antennae with inner flagella one-half as long as outer, slender. Squame of each second antenna long and slender, sharply pointed. Interantennal spine triangular, bluntly pointed, surface either flat or concave. Exopods of third maxillipedes absent.

Carapace punctate, longer than abdomen; cervical groove and branchio-cardiac grooves deeply impressed, areola narrow.

Sternal keel sharp; lateral processes small and rounded, posterior pair deeply grooved; processes between fourth pereopods short and stout, joined together above.

Great chelae: propodus twice as long as broad, upper margin with a double row of small tubercles, lower margin smooth, or with an obsolete row of small tubercles, cutting edge with five large tubercles, two smooth carinae on upper and under surface reaching from apex to base of dactylus; dactylus long and stout, with three large tubercles on cutting edge, upper margin smooth, upper and under surface each with a smooth carinae reaching from apex to base; carpus with a row of tubercles on upper margin, and two or three rows of small tubercles on surface; merus with a row of tubercles on upper margin.

Posterior pleurobranch rudimentary.

Colour.—Abdomen and carapace olive-green or reddish-brown; chelae dark olive green above, cream below; tips of chelae, carpus and merus, and the pereopods reddish-brown. Whole animal with a translucent waxy appearance.

Habitat.—*Victoria*: Dandenong Ranges (W. Kershaw, 1872); Box Hill (S. W. Fulton); Croydon (F. P. Spry, 1904); Ringwood (E. H. Hennell, 1890); Ferntree Gully; Belgrave (F. Spry); Emerald (E. Jarvis, 1904); Gembrook (S. W. Fulton, 1906); Launching Place (J. Coghill, 1907); Woori Yallock (F. P. Spry, 1912); Warburton; Matlock (S. W. Fulton); Jumbunna (A. E. Kitson, 1901); Foster (J. Clark); Beaconsfield; Loch.

Types in the National Museum, Melbourne.

Fifty-eight specimens examined.

Engaeus villosus sp. nov.

(Pl. I, fig. 10; Pl. IX, fig. 36.)

Male.—Length of average adult specimen, 67 mm.

Rostrum broad, reaching almost to base of third segment of first antennae, apex sharp, straight; carinae tuberculate, half as long as rostrum, continued to apex by three rows of long stout setae.

Eyes large. First antennae each with inner flagellum one-half as long as outer. Squame of each second antenna very slender, inner lobe narrow, sharply pointed. Interantennal spine short, broad and rounded. Exopod of third maxilliped indicated by a small tubercle.

Carapace slightly longer than abdomen; cervical groove obsolete, branchio-cardiac grooves well defined, areola fairly broad. Branchiostegites and anterior of carapace densely, minutely, hirsute; long stout setae scattered over remainder of carapace.

Abdomen broad, smooth, with numerous tufts of long setae. Telson broadly cone-shaped, without median or lateral spines; uropods large,

longer than telson, inner rami rounded, each divided by a longitudinal median carina reaching to posterior margin, without spines; outer rami rounded, each divided by a longitudinal median carina, transverse suture placed at posterior third, three sharp spines on suture. Telson and uropods with numerous tufts of long stout setae.

Sternal keel raised and blunt; first two pairs of lateral processes rudimentary, small but sharp below second pereopods; small and blunt below third pereopods, deeply grooved; processes between fourth pereopods long and slender.

Great chelae short and stout; propodus smooth, twice as long as broad, upper margin formed by two rows of small tubercles; lower margin almost smooth, two or three very small tubercles posteriorly; four tubercles on cutting edge. Dactylus stout, with three tubercles on cutting edge, upper margin smooth; a few tufts of short setae scattered over propodus and dactylus. Carpus with three rows of large tubercles on upper surface, centre of upper surface deeply hollowed; merus with a row of small tubercles on upper margin.

Posterior pleurobranch long and well developed. Posterior arthrobranchs small, last thread-like. No gill-filaments on epipod of first maxilliped.

Female.—Length of average adult specimen, 73 mm.

Similar to male but differs in the form of the outer rami of the uropods, and the great chelae. The outer rami of the uropods are larger than in the male, and the posterior margin of each ramus is broadly crenulate.

Great chelae long and slender, propodus two and one-half times as long as broad, upper margin formed by two rows of small tubercles, lower margin with a single row of very small tubercles, three tubercles on cutting edge; dactylus long and slender, three tubercles on cutting edge, upper margin smooth; propodus and dactylus covered by numerous tufts of long, stout setae. Carpus with two rows of tubercles on upper surface, not grooved as in male; upper margin of merus with a row of small tubercles. All the pereopods densely hirsute.

Colour.—General colouring bright orange. Great chelae, carpus and merus orange; propodus and dactylus bright translucent blue, apex of both and tubercles orange.

Habitat.—*Victoria*: Acheron River flats, near Marysville (E. Clark, Dec., 1935).

Types in the National Museum, Melbourne.

This species somewhat resembles *E. tuberculatus* sp. nov. but is readily separated by the form of the abdomen and great chelae. The differences in the form of the chelae in the sexes of this species is very striking, being constant in all examples.

A series of 135 specimens varying in size from 12 mm. to 73 mm. long examined. Many of the small specimens (25 mm.) are a dull dark blue colour all over, others have the same colouring as the adults. The smallest specimens are salmon pink.

This species burrows both in swampy ground near the river, and higher up the hill in dry, heavily-timbered ground. The burrows in the swamp have a large cone with the opening on the side, near the top of the cone; burrows from eighteen

inches to three feet deep. The burrows on the hillside have no cone, the only indication being a small round hole; hundreds of these holes were found in a few square yards of ground. In an area of four or five square feet, containing numerous holes, all the burrows converge to one central pool of water where whole communities are found. These burrows are from five to seven feet deep. These yabbies are difficult to capture, as there are so many burrows leading into each underground pool; the yabbies escape along other passages when each burrow is dug out. Several square yards of ground have sometimes to be dug before a capture is made.

Engaeus affinis Smith and Schuster.

(Pl. IX, fig. 37.)

Engaeus affinis Sm. and Sch., Proc. Zool. Soc. Lond., 1913, p. 120.

Length of average adult specimen, 60 mm.

Rostrum slender, reaching to base of third segment of first antennae, apex upturned; carinae half as long as rostrum, with four blunt tubercles, continued to apex by two rows long stout setae. In some examples rostrum not reaching base of third segment, apex straight, carinae with three tubercles; carinae sometimes smooth.

Eyes large. First antennae with inner flagella one-half as long as outer, slender. Squame of each second antenna long and slender, sharply pointed. Interantennal spine round, or bluntly pointed. No exopods on third maxillipedes.

Carapace punctate, longer than abdomen; cervical groove and branchio-cardiac grooves obsolete, areola fairly broad.

Sternal keel blunt; lateral processes small and rounded, posterior pair deeply grooved; processes between fourth pereopods long and slender, not joined above.

Telson broadly cone-shaped; inner rami of uropods broad, longer than telson; outer rami each with transverse suture represented by a feeble broken carina, the transverse continuation of the longitudinal carina, lower portion of uropods not flexible, without spines; a few examples have from one to four small spines on the transverse suture.

Great chelae: propodus stout, one and one-half times as long as broad, upper margin with a double row of small tubercles, lower margin with an irregular row of feeble tubercles, cutting edge with four or five large tubercles; dactylus short and stout, with one large tubercle on cutting edge, upper margin smooth, usually divided by a longitudinal carina; carpus with a row of tubercles on upper margin, and one or sometimes two, rows of tubercles on surface; merus with a row of small tubercles on upper margin.

Posterior pleurobranch well developed.

Habitat.—*Victoria*: Warburton (F. J. Williams, 1869); Healesville; Fernshaw (J. A. Kershaw, 1880); Matlock (S. W. Fulton).

Types in the National Museum, Melbourne.

A series of 26 specimens examined.

Genus PSEUDENGAEUS gen. nov.

Carapace higher than broad; smooth or setose. Cervical groove feeble, somewhat "V" shaped.

Rostrum short and broad. Second antennae inserted under the first. First abdominal somite without lateral lobes.

Telson without transverse sutures, entirely calcareous. Sternal keel very broad posteriorly; posterior pair of lateral processes appearing double. Vas deferens on simple short papillae on coxae of fourth pereopods.

Stem of podobranchs without a lateral wing-like expansion. Gill formula 21 + epr.

Genotype *Pseudengaeus strictifrons* sp. nov.

Pseudengaeus strictifrons sp. nov.

(Pl. IX, fig. 40.)

Length of adult specimens, 60 mm.

Rostrum broad, almost as broad at apex as at base, reaching nearly to base of second segment of first antennae; carinae blunt, reaching to apex.

Eyes small. First antennae with inner flagella three-fourths as long as outer; second antennae slender, reaching to second abdominal segment, squames extremely small, not reaching to base of second segment of first antennae, broad and rounded, each with a small blunt terminal spine. Inter-antennal spine small and slender, semi-pyramidal. Exopod of each third maxilliped as a short papilla, one-fourth as long as ischius of maxillipedes.

Carapace shorter than abdomen, two and one-half times longer than broad, one and one-half times higher than broad, branchiostegites with numerous minute scattered hairs. Cervical groove and branchio-cardiac grooves obsolete, areola fairly broad.

Sternal keel blunt; first three pairs of lateral processes small and rounded, posterior pair appearing double, upper portion very small and slightly grooved, sternum swollen below, partly overhanging fourth pereopods.

Great chelae: propodus twice as long as broad, entirely smooth, lower margin smooth posteriorly and with three smooth carinae anteriorly (one on centre of margin and one on each side), cutting edge with eight or nine small tubercles, bordered on each side by smooth carina; dactylus with two smooth carinae on upper margin, cutting edge with five small tubercles, bordered on each side by a smooth carina. Carpus and merus smooth.

Telson entirely calcareous, narrowly cone-shaped, without median or lateral spines, posterior half divided by a longitudinal median groove; uropods entirely calcareous, as long as telson, inner rami each divided by a longitudinal median carina reaching to posterior margin, without posterior or lateral spines; outer rami each divided by a longitudinal median carina reaching transverse suture, four or five small spines on suture.

Habitat.—*Victoria*: Portland (H. W. Davey).

Types in the National Museum, Melbourne.

The size of the squame of each second antenna and the shape of the rostrum readily distinguish this species.

Pseudengacus sternalis sp. nov.

(Pl. IX, fig. 41.)

Length of adult specimens, 47 mm.

Rostrum broad, almost as broad at apex as at base, reaching nearly to base of second segment of first antennae; carinae blunt, reaching to apex.

Eyes very large. Squame of each second antenna rudimentary, represented by a very small blunt spine. Interantennal spine small and slenderly pyriform. Exopod of each third maxilliped indicated by a small papilla.

Carapace as long as abdomen. Cervical groove and branchio-cardiac grooves obsolete, areola fairly broad. Anterior of carapace covered with short, soft down, very dense about rostrum.

Sternal keel narrow from great chelae to third pereopods, very broad and swollen between third and fourth pereopods; posterior pair of lateral processes small, low and flattened, crenulate on posterior margin; sternum below large and swollen, overhanging fourth pereopods.

Great chelae; propodus twice as long as broad, densely punctate, upper and lower margins smooth; dactylus short and stout, upper margin smooth, two small tubercles on cutting edge. Carpus punctate, three small tubercles on upper margin; upper margin of merus smooth.

Pereopods very slender, particularly posterior pair.

Telson narrowly cone-shaped, without spines; uropods large and round, inner rami each divided by a longitudinal median carina, continued to posterior margin, without spines; outer rami each divided by a longitudinal median carina, transverse suture feebly serrated.

Habitat.—*Victoria*: Warragul (J. A. Kershaw).

Type in the National Museum, Melbourne.

Readily separated from *P. strictifrons* by the form of the sternal keel and by the rudimentary squame.

Genus PARASTACOIDES gen. nov.

Carapace as high as broad, minutely tuberculate. Cervical groove deeply impressed, rounded. Abdomen without spines, lateral margins rounded. First somite with lateral lobes large and rounded.

Telson without transverse sutures, entirely calcareous. Sternal keel narrow, flat or slightly rounded. Upper lip short and broad, straight or slightly concave medianly. Vas deferens on simple short papillae on coxae of fourth pereopods.

Stem of podobranchs without wing-like expansions; no pleurobranchs present; posterior arthrobranchs rudimentary.

Genotype *Astacus tasmanicus* Erichson.*Parastacoides tasmanicus* (Erichson).

(Pl. VII, fig. 30.)

Astacus (*Astacus*) *tasmanicus* Erichson, Arch. f. Naturg., xii, p. 94, 1846.*Astacus tasmanicus* White, List Crust., Brit. Mus., p. 72, 1847; von Martens, Monats. Akad. Wiss. Berlin, 1868, p. 618.*Astacopsis tasmanicus* Haswell, Cat. Austrl. Mus., Crust., 1882, p. 178; Ortunann, Proc. Amer. Phil. Soc., xli, p. 292; Faxon, Mem. Mus. Comp. Zool., xl, 8, p. 402, 1914 (*Incertae sedis*).

Length of adult specimens, 75 mm.

Rostrum broad, reaching to base of third segment of first antennae, apex blunt; carinae sharp, carried well back on to carapace, lateral carinae blunt, each ending in a rounded boss.

Eyes large. First antennae with inner flagella seven-eighths as long as outer. Outer antennae slender, reaching to third abdominal segment; each squame broad, reaching to base of third segment of first antennae. Inter-antennal spine very long and slender. Exopods of third maxillipedes reaching to anterior margin of ischius.

Carapace as broad as high, twice as long as broad, shorter than abdomen; cervical groove deeply impressed, rounded; branchio-cardiac grooves obsolete, areola broad. Branchiostegites and anterior of carapace studded with numerous small tubercles tipped with short hairs, dorsum of carapace densely punctate.

Abdomen smooth, lateral margins rounded. Telson narrowly cone-shaped, with a spine on each lateral margin near posterior margin, posterior half divided by a longitudinal median groove; uropods rounded, longer than telson, inner rami each divided by a longitudinal median carina, a spine at apical third of outer lateral margin; outer rami each with nine or ten sharp spines along transverse suture, suture placed at apical third, upper portion of uropods divided by two parallel longitudinal median carinae, one carina on posterior portion. Swimmerets short and slender, especially in male.

Sternal keel narrow, flat or slightly rounded; first two pairs of processes small, slender and sharp; third and fourth pairs larger and rounded, slightly grooved; processes between fourth pereopods long and stout. Below lateral processes of third pereopods is a pair of large deep openings, largest in female.

Great chelae short and stout; propodus twice as long as broad, densely tuberculate; upper margin serrated, lower margin smooth, cutting edge with one large and two or three small tubercles; dactylus short and stout, densely tuberculate, with cutting edge smooth or with a few feeble tubercles. Carpus triangular, with a row of small tubercles on upper margin, surface punctate; merus punctate, upper margin feebly serrated.

Gill formula :

Podobranchiae		Arthrobranchiae		Pleuro-branchiae	Total
		Anterior	Posterior		
vii	0 + ep.r.	0	0	0	0 + ep.r.
viii	1	1	0	0	2
ix	1	1	r	0	2 + r
x	1	1	r	0	2 + r
xi	1	1	r	0	2 + r
xii	1	1	r	0	2 + r
xiii	1	1	r	0	2 + r
xiv	0	0	0	0	0
6 + ep.r.		+ 6	+ 5r	+ 0	= 12 + 5r + ep.r.

Colour.—General appearance from above, light chocolate brown; translucent orange below. Pereopods, merus of chelae and tips of chelae translucent orange; underside of carpus violet.

Habitat.—*Tasmania*: Near Lake Margaret Power Station, Mt. Lyell (R. Murray, 1935); Strahan; Queenstown.
Type (female) in Berlin Museum.

Twenty-two specimens examined.

In his key to the subgenera of *Astacus*, Erichson (1864, p. 88) defined *Astacus* (*Astacus*) as having the outer antennae inserted at the side of the inner; the telson and uropods quite calcareous; the bases of the fifth pair of legs with a gill; and the appendages of the first and second abdominal somites of the males being modified as styles.

He included here one Australian species *A. (A.) tasmanicus*, described from one female.

A series of 10 specimens of land crayfishes received from Mr. R. M. Murray, of Mt. Lyell, Tasmania, near the type locality of *A. (A.) tasmanicus*, agree in measurements, sculpture and shape with *tasmanicus*, but differ in three important characters:

- (1) The first abdominal somite of the male is devoid of appendages, as is the case in all species of Parastacidae.
- (2) The outer antennae are inserted under the inner. This character was noticed by von Martens (1868), who said (p. 619) that on comparing Erichson's specimens he could find no difference in the placing of the antennae in *tasmanicus* and in the two species of *Engaeus* (*fossor* and *cunicularius*), which have the outer antennae inserted under the inner. He also noticed that in the European forms with which *tasmanicus* was included, the telson has a complete transverse suture, while *tasmanicus* has transverse sutures only on the outer rami of the uropods, as in *Engaeus*.
- (3) No gills on the fifth pair of legs.

With the other characters corrected the last character remains the only one to prevent the identification of the species.

Erichson defined *Astacus* (*Cherax*) as having the outer antennae inserted at the side of the inner; the fifth pair of legs without gills; the telson and uropods half membranous; and the first abdominal somite of the male without appendages, and those of the second somite formed the same as the following.

He described one species, *A. (C.) preissii*, from south Western Australia. The type is lost; von Martens was unable to

find it in 1868, and, according to McCulloch (1917), it was not in the Berlin Museum in 1914.

Huxley (1878) raised the subgenus to generic rank, under the name *Chaeraps*. Various authors have referred several species to this genus, but all have a well-developed pleurobranch on each of the fifth pair of legs, making their inclusion in Erichson's genus impossible. McCulloch (1917) noted this fact, and considered *intermedius* Smith to be synonymous with *preissii* in spite of the fact that *intermedius* has gills on the fifth legs.

The two species, *A. tasmanicus* (with gills on the fifth legs) and *C. preissii* (without gills on the fifth legs), have been identified only doubtfully by subsequent authors. One is thus forced to the conclusion that Erichson attributed the presence or absence of gills on the fifth legs to the wrong specimens. With this character reversed *preissii* becomes the specimen with the gills, and the genus *Cherax* then contains all the species hitherto doubtfully referred to it; and the specimens which otherwise fit the description of *tasmanicus* Erichson (nec *tasmanicus* Smith) are identified with certainty.

Family AUSTROASTACIDAE fam. nov.

First abdominal segment devoid of appendages in both sexes.

Podobranchs without either a bilobed plaited lamina or a lateral wing-like expansion. Epipods of first maxillipedes without branchial filaments. The fourth pereopods without gills.

Each first antenna with the second flagellum small or absent.

Carapace strongly vaulted posteriorly. Abdomen small. First somite without lateral lobes. Telson and uropods entirely calcareous, not divided by transverse sutures.

Genus AUSTROASTACUS gen. nov.

Carapace higher than broad, highly vaulted posteriorly. Abdomen small, swimmerets long; first somite without lobes or spines.

Telson and uropods entirely calcareous, without transverse sutures.

First antennae each with either one or two flagella. Second antennae inserted below first. Upper lip short and broad.

Sternal keel flattened or feebly raised. Vas deferens on simple short papillae on coxae of fourth pereopods. Posterior pleurobranchs absent. Podobranchs without wing-like expansions.

Genotype *Engacus hemicirratulus* Smith and Schuster.

Key to Species of AUSTROASTACUS gen. nov.

First antennae each with one flagellum

HEMICIRRATULUS (Sm. and Sch.)

First antennae each with two flagella CYMUS sp. nov.

Austroastacus hemicirratulus (Smith and Schuster).

(Pl. X, figs. 1-3; Pl. XI, figs. 1-3.)

Engaeus hemicirratulus Sm. and Sch., Proc. Zool. Soc. Lond., 1913, p. 123, pl. 20-22, figs. 34, 35, 37, 38.*Male*.—Length of average adult specimen, 70 mm.

Rostrum broad, apex blunt, with two conspicuous tufts of long bristly setae at apex; carinae indistinct, but each indicated by a row of long setae.

Eyes large. First antennae each with one flagellum. Second antennae short and slender, one-eighth longer than first; squames each with a very short inner lobe terminated by a long slender sharp spine. Interantennal spine short, broad, bluntly pointed. Exopods of third maxillipedes absent.

Carapace punctate, minutely tuberculate on branchiostegites; posterior twice as broad as anterior; one and one-half times higher than broad, three times longer than broad. Carapace very short posteriorly, highly vaulted, not covering top of last pereopod, and only part of podobranchis of second and third pereopods. Cervical groove and branchio-cardiac grooves strongly impressed, areola narrow.

Sternal keel obsolete, feebly rounded, lateral processes small, sharp below second pereopods, posterior pair rounded, deeply grooved; processes between fourth pereopods long and slender.

Abdomen punctate, with numerous tufts of long bristly setae; first segment broad and rounded, without lobes or spines at lateral margins. Telson large and rounded, more than twice the size of uropods, entirely calcareous, without spines, but having a large round swelling in middle below anterior margin; uropods shorter than telson, small and slender, calcareous throughout, without trace of transverse sutures, each with a smooth carina in middle ending in a sharp spine almost on posterior margin; telson and uropods covered by numerous tufts of long bristly setae.

Great chelae with numerous punctures and tufts of long bristly setae; propodus very stout, two and one-half times longer than broad, bordered by a row of large tubercles on upper, lower and posterior margins, three or four large tubercles on cutting edge; dactylus stout, with three or four large tubercles on cutting edge, several tufts of long bristly setae on upper margin; a smooth longitudinal ridge on upper and lower surface of propodus and dactylus; upper margin of merus smooth or feebly serrated; upper margin of carpus with a single row of large tubercles.

Gill formula:

Podobranchiae		Arthrobranchiae		Pleurobranchiae	Total
		Anterior	Posterior		
vii	ep.	0	0	0	ep.
viii	1	1	0	0	2
ix	1	1	1	0	3
x	1	1	1	0	3
xi	1	1	1	1	4
xii	1	1	1	1	4
xiii	1	1	1	1	4
xiv	0	0	0	0	0
6 + ep.		+ 6	+ 5	+ 3	= 20 + ep.

Hooked filaments only on the inner side of podobranchiae. Remaining branchiae without hooks.

Female.—Length of average adult specimen, 80 mm.

Similar to male, but differs in having the carapace broadest in middle, posterior only slightly broader than anterior. Abdomen proportionately broader and longer than in male.

Colour.—Anterior of carapace pale brown, anterior edges of rostrum and antennal scale orange; remainder of carapace greyish-brown, more brownish towards outer edge, usually mottled with irregular whitish spots on branchiostegites. Abdomen greyish-brown, brown on lateral edges and tail fan. Pereopods brownish-white, dark brown at tips; great chelae bright orange, dactylus and propodus greyish-brown, tubercles on inner edge whiter. Abdominal swimmerets pale brown.

Habitat.—*Victoria*: Thorpdale; Warragul; Moyarra; Kongwak; Valley View (J. Greenwood, 1935); Bena; Trafalgar; Korumburra; Warburton; Erica.

Types in National Museum, Melbourne.

MS. notes and plates illustrating this species were prepared many years ago by Professor Sir Frederick McCoy for use in the unpublished continuation of his *Prodromus of the Zoology of Victoria*. The name used in his notes is *Hemicirratulus hystrix* (gen. and sp. nov.). McCoy's material was subsequently loaned to G. Smith, who described this species (with Schuster, 1913) as a species of *Engaeus*, using McCoy's generic name for the specific name. McCoy's plates have been used in the present paper.

Austroastacus cymus sp. nov.

(Text fig. 2.)

Male.—Length of average adult specimen, 39 mm.

Rostrum short and broad, reaching to base of second segment of first antennae, apex blunt and straight; carinae feeble, reaching half-way to apex, continued by rows of long stout setae.

Eyes large. First antennae each with two flagella, inner flagellum short and slender, one-fifth as long as outer. Second antennae long and slender, reaching to cervical groove. Each squame very slender, apex sharp. Exopods of third maxillipedes absent.

Carapace two and one-half times longer than broad, punctate, minutely tuberculate on branchiostegites. Cervical groove and branchio-cardiac grooves strongly impressed, areola narrow.

Abdomen two-thirds as long as carapace, very slender, with numerous tufts of long stout setae. Telson small, narrowly cone-shaped, without spines; uropods slender, each divided by a longitudinal median carina, outer rami each produced to a blunt point, inner rami rounded. Telson and uropods covered by numerous tufts of long stout setae.

Sternal keel raised and blunt between second and third pereopods.

Great chelae densely punctate, covered by numerous tufts of long stout setae; propodus twice as long as broad, upper margin with five or six small tubercles, lower margin smooth, cutting edge with two small tubercles;

dactylus stout, with one small tubercle on cutting edge, upper margin smooth; upper and lower surfaces of both propodus and dactylus divided by a longitudinal carina. Carpus densely punctate, a row of small tubercles on upper margin; upper margin of merus feebly serrated.

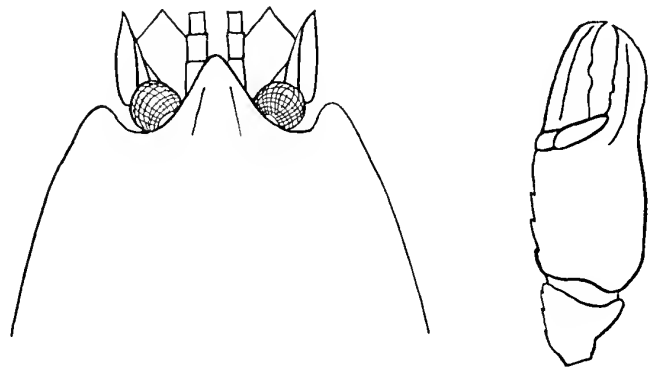


FIG. 2. *AUSTROASTACUS CYMUS* sp. nov.

Female.—Length of average adult specimen, 53 mm.

Similar to male, but differs in having a much larger abdomen and tail fan. The abdomen is almost as long and broad as the carapace, and the uropods are as large as the telson.

Colour.—Wholly bright orange.

Habitat.—*Victoria*: Dondangadale (between Myrtleford and Whitfield) (E. Clark, Dec., 1935).

Types in National Museum, Melbourne.

A series of 38 specimens, ranging in size from 4 mm. to 53 mm. long examined. One female had eggs attached to the swimmerets; another female, found in a small burrow leading off the main burrow, had several newly-hatched young (from 4 mm. to 10 mm. long).

This species burrows in swampy patches in the valley and on the dry land on the tops and sides of heavily-timbered hills. Entrances to burrows in swampy ground have cones three or four inches high, with an opening in the top; the burrows are eighteen inches to three feet deep. On the hills no cones are formed, the burrows being indicated only by small round holes, usually underneath fallen logs or stones; these burrows are from eighteen inches to four feet six inches deep.

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* An account of a freshwater crayfish from Mortlake, based on a single specimen (which cannot now be found) which he proposed, if it should prove to be a new species, to call *Astacoides quineyi*. The account is inadequate and useless for the identification of any of the four species found in that locality. The name has therefore been omitted from the catalogue as *nomen nudum*.

EXPLANATION OF PLATES.

Plate I.

- Fig. 1. Podobranch of *Euastacus serratus* (Shaw) ; 1a, transverse section of same.
Fig. 2. Podobranch of *Astacopsis gouldi* sp. nov. ; 2a. transverse section of same.
Fig. 3. Podobranch of *Cherax destructor* sp. nov. ; 3a transverse section of same.
Fig. 4. Sternal keel of *Cherax albidus* sp. nov.
Fig. 5. Sternal keel of *C. destructor* sp. nov.
Fig. 6. Sternal keel of *C. punctatus* sp. nov.
Fig. 7. Sternal keel of *Astacopsis tricornis* sp. nov.
Fig. 8. Sternal keel of *Geocharax gracilis* sp. nov.
Fig. 9. Sternal keel of *Engaeus fossor* Erichson.
Fig. 10. Sternal keel of *E. villosus* sp. nov.
Fig. 11. Sternal keel of *Pseudengaesus strictifrons* sp. nov.

Plate II.

Head ; a, interantennal spine and upper lip ; b, great chela, male ; c, great chela, female.

- Fig. 12. *Euastacus serratus* (Shaw).
Fig. 13. *E. yarraensis* (McCoy).
Fig. 14. *E. serratus* s.sp. *hirsutus* (McCulloch).

Plate III.

- Fig. 15. *E. nobilis* (Dana).
Fig. 16. *E. nobilis* s.sp. *kershawii* (Smith).
Fig. 17. *E. fleckeri* (Watson).

Plate IV.

- Fig. 18. *Cherax tenuimanus* (Smith).
Fig. 19. *C. quadricarinatus* (von Martens).
Fig. 20c. Gynandromorph of *C. quinquecarinatus* (Gray).

Plate V.

- Fig. 20. *C. quinquecarinatus* (Gray).
Fig. 21. *C. bicarinatus* (Gray), drawn from a specimen from Gray's type material.
Fig. 22. *C. bicarinatus* (Gray), drawn from a specimen from Smith's type material.
Fig. 23. *C. destructor* sp. nov.

Plate VI.

- Fig. 24. *C. albidus* sp. nov.
Fig. 25. *C. punctatus* sp. nov.
Fig. 26. *Geocharax gracilis* sp. nov.

Plate VII.

- Fig. 27. *Astacopsis franklinii* (Gray).
Fig. 28. *A. gouldi* sp. nov.
Fig. 29. *A. tricornis* sp. nov.
Fig. 30. *Parastacoides tasmanicus* (Erichson).

Plate VIII.

- Fig. 31. *Engaeus fossor* Erichson.
Fig. 32. *E. quadrimanus* sp. nov.
Fig. 33. *E. phyllocercus* Sm. and Sch.
Fig. 34. *E. sericatus* sp. nov.
Fig. 35. *E. cunicularius* Erichson.

Plate IX.

- Fig. 36. *Engaeus villosus* sp. nov.
Fig. 37. *E. affinis* Sm. and Sch.
Fig. 38. *E. victoriensis* Sm. and Sch.
Fig. 39. *E. tuberculatus* sp. nov.
Fig. 40. *Pseudengaeus strictifrons* sp. nov.
Fig. 41. *P. sternalis* sp. nov.

Plate X.

Austroastacus hemicirratulus (Smith and Schuster).

- Fig. 1. Under side of male, nat. size.
Fig. 1a. First abdominal appendage of male, $\times 2$.
Fig. 2. Dorsal view of female, nat. size.
Fig. 2a. Carapace of female viewed from front, $\times 2$.
Fig. 2b. Rostrum, $\times 2$.
Fig. 2c. Inner side of left chelae, nat. size (reversed on plate).
Fig. 2d. Outer side of ditto.
Fig. 2e. Outer side of right chelae, nat. size.
Fig. 2f. Inner side of ditto.
Fig. 2g. Telson, $\times 2$.
Fig. 3. Young specimen, nat. size.

Plate XI.

Austroastacus hemicirratulus (Smith and Schuster).

- Fig. 1. Side view of male, nat. size.
Fig. 1a. Dorsal view of male.
Fig. 1b. Rostrum, $\times 3$.
Fig. 1c. Ditto, side view.
Fig. 1d. Four final segments of first antenna, $\times 50$.
Fig. 1e. Three terminal segments of second antennae, $\times 50$.
Fig. 1g. Ditto.
Fig. 1h. Underside of head, $\times 6$.
Fig. 1i. Branchiostegite removed to show podobranchs in position.
Fig. 1k. Podobranchs removed to show remaining gills.

NOTE ON THE IDENTITY OF *LEPIDODENDRON*
MANSFIELDENSE McCOY MS. WITH
L. VELTHEIMIANUM STERNBERG.

By F. Chapman, A.L.S., F.G.S.

(Plate XII.)

In the National Museum collection of fossils from the Lower Carboniferous of Mansfield, are two specimens of a *Lepidodendron* to which Sir F. McCoy gave the MS. name *L. mansfieldense*. The earliest record of this name is in a paper by G. Sweet and is based on a memorandum given to that author by McCoy (Sweet, 1890, p. 2); in this memorandum McCoy states that the species is "quite distinct from the *Lepidodendron australe* McCoy of the Avon River, Gippsland."

Professor Birbel Sahni (1926, p. 238) confuses the two species, in saying: "In Victoria the characteristic Upper Devonian species, *Lepidodendron* (*Leptophloeum*) *australe*, persists into the Avon Sandstones which are strongly unconformable to the Middle Devonian strata in that region, and have moreover, been assigned by McCoy on palaeontological evidence, to a Lower Carboniferous horizon. In the Mansfield beds of Victoria *L. australe* is found in association with Lower Carboniferous fish remains."

The first intention of this note was to establish the cheironymic record of *L. mansfieldense*, but a detailed examination of two specimens marked by McCoy for figuring, proves their identity with *Lepidodendron Veltheimianum* Sternberg.

Lepidodendron Veltheimianum Sternberg.

Lepidodendron Veltheimianum Sternberg, 1825, pl. iii, fig. 1.

Sagenaria Veltheimianum (Sternberg) Goeppert, 1852, pls. xvii-xxiv.

Lepidodendron Veltheimianum Sternberg, Feistmantel, 1890, p. 139, pl. x, figs. 4, 5; Seward, 1910, p. 171, text figs. 157, 185, 186a, b.

The two examples of "*L. mansfieldense*" marked "Figured specimen" by McCoy in the National Museum collection were McCoy's selected syntypes for his *L. mansfieldense*. They are now plesiotypes of *L. Veltheimianum*.

One of these (Pl. XII, fig. 1), is the more perfectly preserved and may represent the inner cortex of the stem, the

specimen being in the "Bergeria" stage, in which the leaf-cushions are distinct but much elongated. A wax impression shows these leaf-cushions in relief (see Seward, 1910, figs. 185b). In places the ligular pit is clearly seen as a small oval depression, through which passes the leaf-strand. This specimen measures 10 cm. in length and 4.6 cm. in greatest width.

The second example (fig. 2) is a flattened convex stem more decorticated than the first specimen (fig. 1). It represents the "Knorria" stage of a *Lepidodendroid* stem. In this the leaf-cushions have been nearly destroyed, their position being shown as longitudinal furrows. Occasionally, however, the leaf-cushions are indistinctly seen (see Seward, 1910, figs. 185a). This example has a length of 23 cm. and a width of 9.6 cm.

Age.—In Australia and elsewhere this species is characteristic of rocks of Lower Carboniferous age.

Distribution.—*Victoria*: Gippsland; Mansfield; Glen Falloch (det. F.C., Nat. Mus. Coll.). *New South Wales*: Smith's Creek; Rouchel River, near Stroud (W. B. Clark and O. Feistmantel); Burindi Series. *Queensland*: Bobuntungen, Drummond Range (T. Woods). *Western Australia*: Kimberley area, N. of Derby (*L. cf. Veltheimianum* fide, David, 1932, p. 61).

This species is also typical of the Lower Carboniferous in many other parts of the world, including Europe, Asia, North America and Brazil.

A variety of *Lepidodendron Veltheimianum*, which corresponds to the "Knorria" stage of the Mansfield specimen (Pl. XII, fig. 2), occurs in the Lower Coal Measures of Missouri. It was named *L. rimosum* Sternberg var. *retro-cortcatum* by David White (1899, p. 196, pl. liv, figs. 3, 4).

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EXPLANATION OF PLATE XII.

- Fig. 1. *Lepidodendron Veltheimianum* Sternberg. Impression of cortical layer of stem, representing the "Bergeria" stage of fossilization. Plesiotype (formerly cheirotpe of *L. mansfieldense* McCoy). Nat. Mus. Coll. (Reg. No. 14,048). Nat. size.
- Fig. 2. *L. Veltheimianum* Sternberg. Decorticated stem showing the "Knorria" stage. Plesiotype (formerly cheirotpe of *L. mansfieldense* McCoy). Nat. Mus. Coll. (Reg. No. 14,049). *Circ.* $\frac{2}{3}$ nat. size.

MURIDAE RECORDED FROM VICTORIA.

*By C. W. Brazenor,
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(Plates XIII-XVI.)

Australian rats and mice, as a group, received little attention from Australian systematists till recent years. Few examples of early collecting are preserved in this country. Almost all the work of classification and description has been carried out in Europe, and based upon a few specimens; some of these descriptions are broad enough, in the light of modern specialization, to apply to more than one species, and without early material from typical collecting grounds the task of identifying species already described, and of describing new, must necessarily be difficult and doubtful.

The National Museum possesses good series of Victorian forms, taken in 1857 by the Polish naturalist, W. Blandowski, who collected in north-western Victoria near the junction of the Murray and Darling Rivers. Unfortunately when Blandowski left the State he took with him all notes and data relating to the collection.

Since then our murine fauna has been greatly depleted in species and individuals. Though destruction of habitat by agriculture, bush fires, etc., is largely responsible, the introduction of foreign members of the same family is also a contributing factor. European rats have spread throughout the State and, because of their greater pugnaciousness and fertility, have driven out and replaced native species in many districts. This usurpation will no doubt continue until all native species are extinct, except possibly the Water Rat, whose size and strength may allow it to hold its own.

Many Australian rats and mice are highly specialized and as peculiarly Australian as any marsupial. Amongst these the Water Rat may, perhaps, be placed first, though the Rabbit Rats and the Jerboa Mice have almost equal claims. Its fine, closely-furred pelt of comparatively large size has lately been in demand as a commercial fur-skin, and many thousands of these rats are trapped yearly; though still common in many places the animal cannot long survive such systematic depletion of its numbers. Most of our marsupial mammals are

now protected by law, and it cannot be too strongly urged that some similar action be taken in regard to this typically Australian rodent. Suggestions have been made that the animal might be farmed on a commercial basis as is the Musk Rat in America; it is an omnivorous feeder so that a food supply should be comparatively simple, it is reasonably hardy, and when in good condition it produces four young at a birth. Furthermore, selective breeding should improve the quality and value of the pelts. This would seem to be the only way to maintain a supply, for sooner or later the wild animals must be trapped out.

The following list of Victorian rats contains all species which have been recorded from the State. Ridgway's system for names of colours is used (*Colour Standards and Nomenclature*).

Family **MURIDAE** Gray 1821.

Rat-like rodents, none with more than three cheek-teeth in each half of each jaw. Australian members are divided into two sub-families.

Sub-family **HYDROMYINAE**.

Rats having only two cheek-teeth in each half of each jaw. There are two genera, both confined to Australasia, one of which is found in Victoria.

Genus **HYDROMYS** Geoffroy 1805.

This genus contains the Australian Water Rats. Large, heavily-built, semi-aquatic animals with partially-webbed toes; they frequent banks of rivers, creeks, and lagoons.

Hydromys chrysogaster Geoffroy 1805.

Hydromys chrysogaster Geoffroy, Ann. Mus. d'Hist. Nat., vi, p. 90, 1805; Gould, Mamm. Aust., iii, pl. xxiv, 1863; Collet, Zool. Jahrb., p. 841, 1887; Thomas, P.Z.S., p. 247, pl. xxix, fig. 7, 1889; Ogilby, Aust. Mus. Cat., No. 16, Aust. Mamm., p. 101, 1892; Wood Jones, Mamm. Sth. Aust., iii, p. 290, 1925.

Hydromys leucogaster Geoffroy, Ann. Mus. d'Hist. Nat., vi, p. 90, 1805; Gould, Mamm. Aust., iii, pl. xxvi, 1863; Thomas, P.Z.S., p. 790, 1908.

Hydromys fulvogaster Jourdan, Comptes Rendus Acad. Sci. Paris, v, p. 523, 1837.

Hydromys fulvoventer Jourdan, Ann. Sci. Nat., (2) viii, p. 372, 1837; Thomas and Dolman, P.Z.S., p. 790, 1908.

The Eastern Water-Rat was originally described from a specimen collected in Tasmania. Geoffroy says, "Pelage brun-marrons en dessus, orange en dessous," Gould better described the colour as "black mingled with buff, the former predominating" above, and "rich, deep, reddish orange" below. However, the colour of the animal is very variable, and on the dorsal surface depends to a great extent on the number and length of the black hairs. Many variants have been described as distinct species, but the present practice is to divide the species into the following geographical races:

Hydromys chrysogaster chrysogaster Geoffroy.

The originally-described form in which the dorsal colour is very dark brown (almost black) and the ventral surface deep orange. The abrupt change of the long hairs to white on the sides of the body produces a well-defined line of demarcation between the dorsal and ventral surfaces.

Type Locality.—Tasmania.

Hydromys chrysogaster fulvolavatus Gould.

Hydromys fulvolavatus Gould, Mamm. Aust., iii, pl. xxv, 1863; Thomas and Dolman, P.Z.S., p. 790, 1908.

Hydromys chrysogaster fulvolavatus Collett, P.Z.S., p. 323, 1897; Wood Jones, Mamm. Sth. Aust., iii, p. 293, 1925.

A pale form in which black hairs are few and the general colour of the dorsal surface is orange-tawny; the ventral surface is not as richly orange and grades gently into the dorsal colouration.

Type Locality.—River Murray, South Australia.

Hydromys chrysogaster lutilla Gould.

Hydromys lutilla Gould (ex. Macleay MS.), Mamm. Aust., Intro., 1863; Thomas and Dolman, P.Z.S., p. 790, 1908.

A grey form with a white ventral surface and no white tip to the tail.

Type Locality.—New South Wales.

Hydromys chrysogaster reginae Thomas and Dolman.

Hydromys chrysogaster reginae Thomas and Dolman, P.Z.S., p. 790, 1908; Thomas, Ann. Mag. Nat. Hist. (8), iv, p. 197, 1909.

A grey form with a buffy ventral surface. Tail with the usual white tip.

Type Locality.—Queensland.

Through the kindness of Mr. T. E. Rose, of Brunswick, Victoria, I had the opportunity to examine some thousands of Water Rat skins from various localities in Victoria, but principally from northern (Murray River) districts. Practically all colour forms were found amongst them, but no specimen had a wholly-black tail, though the white tip varied in length from half-an-inch to more than five inches.

Description of an Average Victorian Specimen.

General colour olive-tawny, suffused on the neck and forepart of the body with an orange hue. Dorsal surface grizzled with black hairs which are not sufficiently numerous to hide the yellow fur. Sides of body and outer sides of limbs lighter. Ventral surface buffy-yellow. Head a little darker than body, cheeks with an orange-buffy patch below the eye. Mystacial vibrissae long and numerous; shorter anterior hairs white, longer posterior hairs black. Ears short and dark brown. Basal inch of tail clothed with hair of body, remainder with stiff adpressed hair which completely hides scales; black for a varying distance of somewhat more than half its length, then with a conspicuous white tip. Manus and pes well covered with silky adpressed hair. Manus with a black patch on the wrist; phalanges and nails white. Pes uniformly dark brown.

Skull.—Heavily built, rounded, and without any marked ridges. In profile the upper border is remarkably straight. Bullae small.

Teeth.—Incisors long and strong. Two molars only, the anterior nearly three times as long as the posterior and divided into three laminae in the upper and two in the lower jaw.

General Dimensions.—Head and body, 320 mm.; tail, 317 mm.; hind foot, 73 mm.; ear, 19 mm.

Dimensions of Skull.—Greatest length, 55 mm.; basal length, 50.5 mm.; greatest breadth, 27 mm.; nasals, 17.5×6.5 mm.; interorbital breadth, 7.5 mm.; palate length, 29 mm.; breadth inside M^2 , 7.5 mm.; breadth outside M^2 , 11 mm.; diastema, 15 mm.; palatal foramina, 5 mm.; upper molar length, 8.5 mm.

The above description applies to about 65 per cent. of the rats examined, but the perfect gradation from very deep brown to grey does not allow of any sharp division. An increase, or otherwise, of black hairs causes variation in the depth of dorsal colour and also in the distinctness of the line of demarcation between the dorsal and ventral surfaces; this line may be well marked or absent. Of the remaining skins about 10 per cent. are of varying degrees of greyiness to a cold grey above and whitish below, and 25 per cent. are darker to a deep brown above and orange below. Specimens almost black above and reddish-orange below are not common, and seldom exceed more than one in each batch of 400 to 600 skins.

Though specimens can be found to match most of the geographical races mentioned above, there is obviously little use in so classifying them; great variation in colour occurs in a single and quite restricted locality, and the species must be considered generally, rather than racially, variable in colour. Interbreeding between the various colour forms takes place. The suggestion is ventured that at least some of the subspecific forms mentioned above are founded on insufficient material and cannot be accepted as valid.

The Water Rat is not uncommon in Victoria and is widely distributed. Its usual habitat is a burrow in the bank of a stream or lagoon, but sometimes it lives in a fallen log. The burrow, which is long and usually inclined upwards from the entrance, ends in an enlarged chamber containing a nest of grass, leaves, etc. The animal is omnivorous in diet and will take molluscs, crustaceans, fish, small water birds and coarse grass or rushes. Usually four young are delivered at a birth.

Subfamily **MURINAE** Baird 1857.

This subfamily includes the true rats and mice; all are small and have three molar teeth in each half of each jaw. The tail is usually long and scaly.

Genus **RATTUS** Fitzinger 1867.

The true or normal rats. Skull strongly built, with well-marked supraorbital ridges which usually extend back to the outer corners of the interparietal. Front edge of zygomatic plate always convex. Molars normal, the laminae not greatly tilted; no anterior-internal cusp on M¹.

Rattus assimilis (Gould).

Mus assimilis Gould, P.Z.S., p. 241, 1857; id. Mamm. Aust., iii, pl. xv, 1863; Collet, Zool. Jahrb., p. 838, 1887; Ogilby, Aust. Mus. Cat., No. 16, Aust. Mamm., p. 105, 1892.

Epimys assimilis Thomas, Ann. Mag. Nat. Hist., (8), vi, p. 605, 1910; Troughton, Rec. Aust. Mus., xiii, p. 119, 1920.

The Allied Rat is the most common indigenous Victoria rodent and is found almost throughout the State. It is a plump little animal with long and very soft fur.

Description of an Average Victorian Specimen, based on Examination of over 100 Examples.

General colour greyish-brown. Dorsal fur (25 mm.) slate for four-fifths of its length, tipped with wood-brown, the grey showing through, and the whole darkened by numerous long black guard-hairs which, on the hinder part of the body, are twice as long as the fur. Sides of body but little lighter, grading into ventral colouration without a line of demarcation. Ventral surface greyish-white; hairs basally grey with dull white tips. Head as body; cheeks slightly greyer, a few black hairs around the eye. Mystacial vibrissae long (50 mm.); black except for a few anterior hairs which are tipped with white. Ear long, dark brown; outer surface sparsely sprinkled with a few dark-brown, adpressed hairs, inner surface with even fewer short, silvery white hairs. Tail about as long as head and body, uniformly dark-brown; sparsely clothed with short, stiff, brown hairs. Manus and pes well clothed with soiled white, adpressed hair.

Skull.—Slender, comparatively smooth and rounded, but with raised supra-orbital beads diverging backwards towards the outer corners of the interparietal. Muzzle comparatively long and narrow. Bullae about half length of diastema.

Teeth.—Incisors long and slender. Molars comparatively small and narrow.

General Dimensions (from flesh).—Head and body, 161 mm.; tail, 170 mm.; hind foot, 33 mm.; ear, 23 mm.

Dimensions of Skull.—Greatest length, 41.5 mm.; basal length, 37.5 mm.; greatest breadth, 21.5 mm.; nasals, 17×4.5 mm.; interorbital breadth, 5.5 mm.; palate, 19 mm.; breadth inside M^2 , 4 mm.; breadth outside M^2 , 8.8 mm.; palatal foramina, 7.5 mm.; diastema, 11.5 mm.; upper molars, 8 mm.

Type Locality.—Clarence River, New South Wales.

The colour variation in the species is small and is not localized. It depends chiefly upon the length and depth of colour of the light tips of the fur, which may vary from rich yellowish-brown to a much colder, almost grey tone.

The Allied Rat is an inconspicuous, completely nocturnal animal. It prefers a habitat in thick scrub and makes its burrows under the overhanging branches of bushes, under logs, or at the base of thick grass clumps. As a rule the burrows are not deep; they slope gently down to an enlarged chamber in which is a nest of grass. In the outer layers of the nest the grass stems are long and interwoven, but the inner surface is well lined with short, bitten ends. This rat leaves no very noticeable tracks, for its runs seldom extend far from the mouth of its burrow and have not a well-used appearance.

This species does little or no damage. It is entirely vegetarian and its stomach contents disclose in most cases fibrous material such as grass stems.

In 1935 a series of about 60 rats was taken at Portland (in western coastal Victoria), which in general size, colour, and pelage are indistinguishable from *assimilis*. They have, however, a smaller skull, a shorter tail and a shorter pes. They were compared with *Rattus assimilis* and also with *R. greyi*, which occurs in South Australia, but has not been identified in Victoria.

The species *greyi* was described by Gray in 1841, but was not recognized by Gould nor figured in his "Mammals of Australia." Ogilby included it in his catalogue in 1892, but did not follow Gray, describing its colour instead as "intense reddish-brown." This erroneous description was in general use until 1925, when Wood Jones exposed the error and re-established the species as still surviving; he also remarked on its similarity to the description of *assimilis*, which animal he had not seen.

Only three immature specimens of *greyi* are available to this Museum, and except in small size, they are in every way similar in external appearance to *assimilis*. Using measurements of four adult *greyi* published by Wood Jones, the following dimensional comparison may be formulated:

General Size.—The two species are of equal size. In *assimilis* females may attain the size of large males; in *greyi* they are always smaller than large males.

Tail.—The tail of *assimilis* is long, that of *greyi* shorter. In large *assimilis* the tail is proportionally longer, in large *greyi* shorter than the mean average of a series.

Pes.—In adults the pes of *assimilis* exceeds 31 mm.; the pes of *greyi* is less than 29 mm.

Skull.—Except in size the skulls of the two species are identical, as are also the proportional size and structure of the teeth. The same minor variations of palatal foramina, zygomatic plate, pterygoid region, etc., occur in each. The skull of *assimilis* is larger and heavier than that of a specimen of *greyi* of the same head and body length.

The two rats are outwardly similar. Dimensional differences are usually considered to be subspecific rather than specific characters, but in this case the relative sizes of male and female, and the proportional length of the tail in large specimens, are additional constant differences, and it is better to regard the two as distinct species unless the gap between can be completely bridged.

The rats collected at Portland are not truly intermediate, for though their tail and ear measurements favour *assimilis* the more important pes and skull dimensions are close to *greyi*. They further resemble *greyi* in the relative sizes of males and females, and in the proportionally shorter tails of large specimens.

The following table gives dimensions of the three groups:

No. of Spec.	Species.	Average Lengths of			
		Tail. Expressed as % of head and body	Pes.	Ear.	Skull.
4	<i>greyi</i> (Wood Jones) ..	76.3	27.2	16 .	36 .
20	Rats from Portland ..	96.1	29.1	20.9	36.2
20	<i>assimilis</i> (east. Vic.) ..	101.1	33.3	23.8	40.6

The Portland rats must therefore be grouped with *greyi*, and do not bridge the gap between that species and *assimilis*. They are therefore described as:

Rattus greyi rarus subsp. nov.

Size and general colouration similar to those of both *greyi* and *assimilis*. Dorsal fur basally grey, tipped with brown, the grey showing through, and the whole modified by long black guard-hairs. Sides of body a little lighter, grading into greyish-white of ventral surface. Ventral hairs basally grey tipped with greyish-white. Head as body; cheeks a little greyer. Mystical vibrissae long; black, a few tipped with silvery white. Ears larger than in *greyi*; dark-brown; almost naked on inner surface, sparsely clothed on outer surface with short, brown, adpressed hair. Tail longer than in *greyi*; shorter than head and body; uniform brown, sparsely clothed with stiff, short, brown hairs. Pes larger than in *greyi*; well clothed with white adpressed hair.

Skull.—Indistinguishable from *greyi*, and smaller than, though otherwise similar to, *assimilis*.

Teeth.—As in *greyi*; proportionally smaller than in *assimilis*. A posterior cusp is present on the lower molars of all three rats.

Dimensions of Male.—Head and body, 163 mm.; tail, 145 mm.; hind foot, 29.5 mm.; ear, 21 mm.

Dimensions of Female.—Head and body, 148 mm.; tail, 148 mm.; hind foot, 29 mm.; ear, 21.5 mm.

Dimensions of Skull.—Greatest length, 36.5 mm.; basal length, 31.5 mm.; greatest breadth, 18.8 mm.; nasals, 14×3.8 mm.; interorbital breadth, 5.2 mm.; palate length, 16.8 mm.; breadth inside M^2 , 4 mm.; breadth outside M^2 , 8 mm.; palatal foramina, 7.3 mm.; diastema, 10 mm.; upper molars, 6.4 mm.

Type Locality.—Portland, Victoria.

Types in National Museum, Melbourne; ♂, C759; ♀, C688.

This eastern race of Grey's Rat replaces *assimilis* in the south-western corner of Victoria, and is similar to that species in its habits and habitat. Its burrows may be found in scrub or in the more heavily-clothed, heath country, and its runs are not conspicuous. At present its only known habitat is the vicinity of Portland.

Rattus lutreolus (Gray).

Mus lutreola Gray, Append. Grey's Travels, p. 409, 1841; Gray, Brit.

Mus. Cat., p. 111, 1843; Gould, Mamm. Aust., iii, pl. xi, 1863.

Epimys lutreola Thomas, Ann. Mag. Nat. Hist., (8), vi, p. 605, 1910.

Rattus lutreola Wood Jones, Mamm. Sth. Aust., iii, p. 229, 1925.

The Swamp Rat inhabits the continent of Australia from east to west, and there is some doubt whether the eastern form should be accorded full specific distinction from the western (*R. fucipes* Waterhouse, 1840).

Description of an Average Victorian Specimen, based on about Sixty Specimens.

A thickly-built, sturdy little animal with short legs and a short tail. Fur long (18 mm.), and though not harsh yet distinctly crisp to the touch. General

colour varies from dusky (blackish) brown to warm yellowish-brown, most commonly the former hue. Dorsal hairs slate for three-fourths of their length, tipped with brown. Guard-hairs numerous and shining black. Sides of body very little lighter, grading without demarcation into buffy-grey of ventral surface. Fur of latter smoky at base, tipped with buffy-white, the buff being more pronounced at the hinder part of body. Head as body; cheeks scarcely lighter. Mystical vibrissae moderate (30 mm.); very dark-brown with lighter tips. Ears short, rounded, and sparsely sprinkled with light-brown adpressed hair on both inner and outer surfaces. Tail short; uniformly dark; sprinkled with stiff, dark-brown hairs. Skin of manus and pes dusky brown; upper surface of both clothed with fine, adpressed, shining brown hair.

Skull.—Stoutly built and strongly ridged, with raised supraorbital beads extending backwards to the interparietal. Compared with the previous species it is shorter in the muzzle and more massive.

Teeth.—Large and heavy. Molars much broader than in the proceeding species.

Dimensions of Skin (from flesh).—Head and body, 154 mm.; tail, 127 mm.; hind foot, 30 mm.; ear, 19 mm.

Dimensions of Skull.—Greatest length, 39 mm.; basal length, 35 mm.; greatest breadth, 21.5 mm.; nasals, 14 × 4 mm.; interorbital breadth, 5 mm.; palate length, 21 mm.; breadth inside M², 4 mm.; breadth outside M², 9 mm.; palatal foramina, 6 mm.; diastema, 11 mm.; upper molars, 7 mm.

Type Locality.—Hunter River, New South Wales.

Once widely distributed throughout the State, the Eastern Swamp Rat is now confined to south-western Victoria. Numbers live in somewhat isolated colonies on the marshy flats of Cape Otway, but do not inhabit scrub or forest country. The flats, which are used for grazing cattle, are dotted with clumps of tea-tree and plantations of pines, within which the rats make their home. The long, deep burrows, which are large in proportion to the size of the rats, are thickly clustered around butts of trees. Much of this country is under water in wet periods, and the burrows become uninhabitable; the rats then migrate to higher ground and burrow into banks and at the base of grass clumps. They do not build nests above ground. Some colonies inhabit coastal sand dunes during the whole year. Unlike the previous species the Swamp Rat makes definite "runs," denuded of grass, and extending for some distance from the mouths of burrows.

The Swamp Rat is entirely herbivorous, stomach contents revealing coarse vegetable matter. It has a liking for the outer bark of roots of trees, and is a pest in new plantations, where it kills many young trees.

Genus PSEUDOMYS Gray 1832.

Contains the Australian mice, the genus being restricted to Australia and Tasmania. The skull is slender and the braincase rounded and without supraorbital ridges. In 1910 O. Thomas divided the genus into four subgenera.

Subgenus PSEUDOMYS s.str.

Size large. Skull flat or concave in posterior nasal region. Front edge of zygomatic plate concave, with projecting point above. Palatal foramina large. Molars high with heavy cusps; no anterior-internal cusp on M^1 (except as an unusual abnormality).

No example of this subgenus has been recorded from Victoria.

Subgenus THETOMYS.

Size medium. Form of skull more normal. Front edge of zygomatic plate less concave; without projecting point above. Palatal foramina long but not widely open. Molars less heavy with a distinct antero-internal cusp on M^1 .

Pseudomys (Thetomys) gouldi (Waterhouse).

Mus gouldi Waterhouse, Voy. "Beagle," ii, pl. 34, fig. 18a and 18b, 1839; Gould, Mamm. Aust., iii, pl. xix, 1863; Ogilby, Aust. Mus. Cat., No. 16, Aust. Mamm., p. 107, 1892.

Pseudomys (Thetomys) gouldi Thomas, Ann. Mag. Nat. Hist., (8), vi, p. 606, 1910; Wood Jones, Mamm. Sth. Aust., iii, p. 315, 1925.

Gould's Mouse has not been recorded from Victoria since 1857, when Blandowski secured several specimens. Unfortunately these were crushed, apparently soon after their preparation as skins, and are completely flattened. The skull of one specimen has been removed but is too fragmentary to reconstruct. Waterhouse's original description is here somewhat extended.

A medium-sized mouse with close soft fur and a long slender pes. General colour tawny-olive. Dorsal fur (11 mm.) slate for a little more than half its length then ochraceous to the tip. The numerous long hairs are of two colours, some yellowish, some black to the base. The general effect is an etched appearance. Sides of body lighter with faint demarcation between the dorsal and ventral surfaces. Throat white, hairs white to base; chest and abdomen yellowish-white, hairs basally smoky-grey for about half their length. Head as body; cheeks lighter, upper lip white. Mystical vibrissae long; brown with lighter tips. Ears fairly long and rather pointed; sparsely clothed on outer surface with light-brown hair, inner surface naked except for

a few silvery hairs at the tip. Tail brown above, whitish beneath; scales about 19 to centimetre; clothed with stiff hairs which are longer and more numerous towards the tip. Manus and pes sparsely clothed with silvery adpressed hair. Pes long and, as far as can be judged from the dried skin, very slender. Metatarsal pads very small.

Skull.—Owing to its crushed condition little can be said of the general form of the skull. The anterior edge of the zygomatic plate is almost evenly concave and does not project above. The palatal foramina is long and (in the present specimen) extends backwards to the anterior third of M^1 . Interorbital region wide, flat, and with squared edges.

Teeth.—The molars are unworn and the rather bold laminae show little tilting. Incisors slender and narrow.

Dimensions of Skin.—Head and body, 99 mm.; tail, 101 mm.; hind foot, 24.8 mm.; ear, 18 mm.

Dimensions of Skull.—Back of frontals to front of incisor teeth, 18.8 mm.; interorbital breadth, 4.3 mm.; palate length, 14.5 mm.; palatal foramina, 5 mm.; diastema, 6.5 mm.; upper molars 4.5 mm.

Type Locality.—New South Wales.

Though it differs slightly from his description there can be no doubt that this is the mouse described by Waterhouse. It has not been recognized in Victoria for nearly eighty years and nothing is known regarding its habits. Gould's specimens taken in South Australia may, or may not belong to this species, but of these he says:

"It inhabits the sides of grassy hills where the soil is loose; its burrows, which are constructed about six inches below the surface, are often of great extent, and it is generally found in small families of from four to eight in number, inhabiting the same burrow and even the same nest of dried grass."

Subgenus LEGGADINA.

Size small. Form of skull normal. Front edge of zygomatic plate straight or convex as in ordinary murines. Palatal foramina narrow. Parapterygoid fossae broad, shallow, scarcely hollowed, the ectopterygoids bordering it externally low, not or scarcely raised above the level of its floor. Molars variable but always with a well-marked antero-internal cusp on M^1 .

Pseudomys (Leggadina) novae-hollandiae (Waterhouse).

Mus novae-hollandiae Waterhouse, P.Z.S., p. 146, 1842; Gould, Mamm. Aust., iii, pl. xxii, 1863; Ogilby, Aust. Mus. Cat., No. 16, Aust. Mamm., p. 109, 1892.

Pseudomys (Gyomys) novae-hollandiae Thomas, Ann. Mag. Nat. Hist., (8) vi, p. 607, 1910.

Pseudomys (Leggadina) novae-hollandiae Brazenor, Mem. Nat. Mus., Melb., No. 9, p. 9, 1936.

Size small. General colour about buffy-brown, pencilled with darker hairs on the back. Dorsal fur (9 to 10 mm.) slate for three-fourths of its length, then wood-brown with lighter tips. Long black hairs numerous. Sides of body and outer sides of limbs lighter; sharply demarcated from ventral colouration. Ventral surface soiled buffy-white; fur basally grey for half its length, the tint being lighter on the throat and chest than on the lower part of the body, then tipped with whitish. Head as body; cheeks lighter, upper lip white. Mystical vibrissae dense, long, black with a few anterior hairs white. Ears long, oval in outline; inner surface nearly naked, outer surface clothed with dark-brown adpressed hair. Tail about as long as head and body; white below except towards the tip where it is uniformly brown; clothed with stiff hairs which are not numerous enough to hide scales (15 to centimetre). Manus and pes buffy-white; sparsely covered with white adpressed hair which barely hides the skin.

Skull.—All available skulls have the occipital region cut away. The brain-case is smooth and rounded and the anterior edge of the zygomatic plate is almost vertical and very slightly concave.

Teeth.—Laminae somewhat tilted. First molar with an antero-internal cingular cusp which in some specimens is more developed than in others.

Dimensions of Skin.—Head and body, 68 mm.; tail, 69 mm.; hind foot, 18 mm.; ear, 15 mm.

Dimensions of Skull.—Back of parietals to tip of nasals, 20 mm.; nasals, 7.8×2 mm.; interorbital breadth, 3.8 mm.; palate length, 12 mm.; palatal foramina, 4.3 mm.; breadth inside M^2 , 2.5 mm.; breadth outside M^2 , 5 mm.; diastema, 5.5 mm.; upper molars, 3.5 mm.

Type Locality.—Upper Hunter River, New South Wales.

This is another species which has not been recorded from this State since the Blandowski expedition in 1857. Evidently at this time it was common, for more than 30 specimens were collected. Little is known of its habits, but Gould said:

"I usually found this species among stones, or under flat slabs of bark left by the Aborigines at their encampments."

Subgenus GYOMYS.

Size small. Skull as in *Leggadina*. Molars quite normal; no antero-internal cusp on M^1 , and molar laminae of the usual murine shape and position.

Pseudomys (Gyomys) fumeus Brazenor.

Pseudomys (Gyomys) fumeus Brazenor, Mem. Nat. Mus. Melb., No. 8, p. 158, 1934.

Only two specimens of the Smoky Mouse are known. Both were taken in one restricted locality near Beech Forest, in the Otway Ranges, and both are males.

General colour quaker-drab, a little darker on the mid-dorsal line. Dorsal fur long (15 mm.), soft, fine; slate grey for four-fifths of length, tipped with mouse grey. Long hairs (20 mm.) numerous; black, imparting a cool tone

to the whole. Sides of body lighter with fewer long hairs, grading into greyish-white of ventral surface. Ventral fur slaty for three-fifths of length, tipped with soiled white, the grey showing through. Head as body; lighter on cheeks and muzzle, upper lip greyish-white. Mystical vibrissae long (39 mm.), shorter hairs white, longer hairs black at base with white tips. Ears long; purplish-grey in freshly-killed animal; sparsely clothed with white and grey adpressed hair. Tail longer than head and body; greyish-brown above, white on sides and below; well clothed with hair 3-4 scales in length which, nevertheless, does not hide scales. Manus and pes white; well clothed with silvery-white adpressed hair which forms a fringe around the nails.

Skull.—Smooth and rounded with a long narrow muzzle. Anterior edge of zygomatic plate slightly concave and sloping gently forward to its base. Bullae small, anterior-posterior length about half that of diastema.

Teeth.—Comparatively large and heavy. Laminae not tilted; no anterior-internal cingular cusp on M^1 .

Dimensions of Skin (from flesh).—Head and body, 115 mm.; tail, 134 mm.; hind foot, 29 mm.; ear, 22 mm.

Dimensions of Skull.—Greatest length, 32 mm.; basal length, 27 mm.; greatest breadth, 16 mm.; nasals, 11.8×4 mm.; interorbital breadth, 5 mm.; palate length, 15.8 mm.; breadth inside M^2 , 3.4 mm.; breadth outside M^2 , 7 mm.; palatal foramina, 6 mm.; diastema, 8 mm.; upper molars, 5.5 mm.

Type Locality.—Otway Forest, Victoria.

No details of the habits of this mouse have been discovered. It inhabits dense, scrubby forest country, which also harbours a large population of *Rattus assimilis*. It is a south-eastern representative of the *alboeinerus-glaneus* group.

Pseudomys (Gyomys) desertor Troughton.

Mastacomys sp. Waite (nec. Thomas), Rept. Horn Expdn., ii, p. 406, pl. xxvi, 1896; id. Proc. Roy. Soc. Vict., x, 2, p. 128, 1898.

Mus nanus Waite (nec. Gould), Proc. Roy. Soc. Vict., x, 2, p. 128, pl. vi, 1898.

Pseudomys (Thetomys) nanus Wood Jones, Mamm. Sth. Aust., iii, p. 314, 1925.

Pseudomys (Gyomys) desertor Troughton, Rec. Aust. Mus., xviii, p. 293, 1932.

The Desert Mouse was for many years confused with the Little Mouse, *Pseudomys (Thetomys) nanus* Gould, 1858, which it outwardly resembles very closely. In 1932 Troughton (loc. cit.) found that it had no cingular cusp on M^1 , and placed it in the subgenus *Gyomys* as a new species.

Size small. General colour about tawny-olive, heavily pencilled with dark-brown hairs. Dorsal fur moderately long (11 mm.) and crisp; slate for more than half its length, tipped with cinnamon-buff. Long hairs numerous, deep brown. Sides of body lighter, grading into brownish-buff of ventral surface. Ventral fur basally grey, tipped with brownish-white, the grey showing through. Head as body; cheeks and muzzle a little lighter. Mystical

vibrissae long (35 mm.), dark-brown. Ear small, brown, a little lighter on the anterior margin; outer surface lightly clothed with adpressed brown hair, inner surface with fewer buffy-white hairs. Tail a little shorter than head and body; brown above, buffy-white below, sharply contrasted; clothed with stiff hairs which are brown on the upper and whitish on the lower surface. Manus buffy-white with dark patch on wrist; pes buffy-white; well clothed with silky adpressed hair.

Skull.—Arched. Nasals bent downwards. Muzzle comparatively thick and heavy. Front edge of zygomatic plate slightly concave and almost vertical.

Teeth.—Incisors curved and comparatively heavy. Molars broad; laminae not tilted, on antero-internal cusp on M^1 .

Dimensions of Skin.—Head and body, 95 mm.; tail, 91 mm.; hind foot, 23 mm.; ear, 12 mm.

Dimensions of Skull.—From back of parietals to tip of nasals, 25.5 mm.; nasals, 11.5×3 mm.; interorbital breadth, 3.8 mm.; palate length, 14 mm.; breadth inside M^2 , 2.8 mm.; breadth outside M^2 , 7.3 mm.; palatal foramina, 4.5 mm.; diastema, 6.5 mm.; upper molars, 5.2 mm.

Type Locality.—Wycliffe Creek, South Australia.

The specimens from which the Desert Mouse was originally described were taken on the Horn Expedition to Central Australia in 1895, and were the only examples known. It is therefore interesting to note that the range of the species originally extended beyond the Central area, and that at one time it was an inhabitant of Victoria. The five specimens in the National Museum were taken by Blandowski near the Murray River in 1857.

Mr. E. le G. Troughton was good enough to compare a Victorian specimen with the type, and pronounced it "indistinguishable from the central form."

No records of habits or habitat have been preserved.

Genus MASTACOMYS Thomas 1882.

The genus was erected for a Tasmanian rat possessing remarkably broadened cheek-teeth. Until 1933 only two specimens were known (the Tasmanian type, and an immature female from Victoria taken many years ago), though skull fragments and teeth had been found in the Wellington Caves, New South Wales, and at Mount Gambier, South Australia. Teeth from the latter locality are smaller than those from other localities, and Thomas created a new species which he called *mordicus*.

Mastacomys fuscus Thomas.

Mastacomys fuscus Thomas, Ann. Mag. Nat. Hist., (5), ix, p. 413, 1882; id. Ann. Mag. Nat. Hist., (9), x, p. 550, 1922; Lydekker, B.M. Cat.

Fos. Mamm., i. p. 227, 1885; Ogilby, Aust. Mus. Cat., No. 16, Aust. Mamm., p. 120, 1892; Wood Jones, Mamm. Sth. Aust., iii, p. 323, 1925; Finlayson, Trans. and Proc. Roy. Soc. Sth. Aust., lvii, p. 125, 1933; Brazenor, Mem. Nat. Mus. Melb., viii, p. 159, 1934.

The Broad-toothed Rat is a stoutly-built, dusky-brown animal with long fluffy fur and a short tail. In external appearance it is almost indistinguishable from *Rattus lutreola*, but it is slightly larger and has longer and softer fur.

General colour yellowish-brown. Dorsal fur slate for three-fourths of its length, tipped with yellow. Long hairs few, shining black. Sides of body a little lighter, grading into buffy-grey of ventral surface without demarcation. Ventral fur basally leaden-grey, tipped with ashy-grey, and the whole washed with buff. Head as body, scarcely lighter on cheeks. Mystacial vibrissae not particularly numerous or long (40 mm.); short anterior hairs mixed black and white, longer posterior hairs black with white tips. Ear short, broad, rounded in outline; clothed with dark brown adpressed hair. Tail slight, short, almost uniform in colour; sparsely clothed with stiff brown hair which is a little lighter on the ventral surface. Manus and pes dusky both above and below; upper surface clothed with adpressed, greyish hair. Nails white.

Skull.—Large, heavy, and in fully adult specimens boldly sculptured. Anterior edge of zygomatic plate deeply concave with a projecting point above. Braincase not tapering forward as in *Rattus*, but suddenly constricted immediately in front of the fronto-parietal suture.

Teeth.—Molars large and very broad; not graduated in size, the third being fully as long as the first. In younger specimens the laminae are very tilted and boldly tuberculated, but in older examples with worn molars these characters are modified, though the sharp-edged, transversely-folded crown pattern is quite different from the rather-rounded crowns of *Rattus*. The incisors are heavy, but considerable variation occurs in breadth; they are more opisthodont than those of any other Victorian rat.

Dimensions of Skin (from flesh).—Head and body, 172 mm.; tail, 123 mm.; hind foot, 34 mm.; ear, 21 mm.

Dimensions of Skull.—Greatest length, 40 mm.; basal length, 35 mm.; greatest breadth, 22.5 mm.; interorbital, 4 mm.; palate length, 22 mm.; breadth inside M^2 , 2 mm.; breadth outside M^2 , 9.5 mm.; palatal foramina, 8 mm.; diastema, 10.3 mm.; upper molars, 10 mm.

Type Locality.—Tasmania.

That the Broad-toothed Rat is still a living Victorian mammal was discovered only recently. No details of its ecology are known. In its only known habitat it lives amongst large numbers of *Rattus assimilis*, and leaves no conspicuous signs, such as "runs," by which its presence can be recognized. Its recent capture, in each case, has been incidental to the trapping of *assimilis*.

The Broad-toothed Rat is nowhere in any considerable numbers, though it inhabits a large area of the Otway Forest.

Thomas has already pointed out the enlarged caecum of *Mastacomys*, and Finlayson its likeness in skull structure to the Holarctic voles. Investigation of the stomach contents of recently-trapped animals disclosed coarse vegetable matter composed of the fibrous stalk of Wire Grass (*Tetrahena*) which is further evidence of the animal's approach to Micritine forms.

Recently several skulls were found in limestone caves on the River Glenelg. The dimensions of these agree with *fuscus*.

Genus LEPORILLUS Thomas 1906.

This genus contains the House-building Rats, large, blunt-headed, long-eared rats having a large but unspecialized pes with the normal six pads. The skull is stoutly built, and the molars are without postero-internal cusps.

Leporillus apicalis (Gould).

Hapalotis apicalis Gould, Proc. Zool. Soc., 1851, p. 126; id. Mamm. Aust., iii, pl. ii, 1863; Krefft, Cat. Mamm. Aust. Mus., p. 64, 1864; Spencer, Rept. Horn Expdn., ii, p. 11, 1896.

Conilurus apicalis Ogilby, Aust. Mus. Cat., No. 16, Aust. Mamm., p. 116, 1892; Waite, Proc. Roy. Soc. Vict., x, 2, p. 115, pl. v, 1898.

Leporillus apicalis Thomas, Ann. Mag. Nat. Hist., (7), xvii, p. 83, 1906; Troughton, Rec. Aust. Mus., xvi, p. 32, 1923; Wood Jones, Mamm. Sth. Aust., iii, p. 334, 1925.

General colour tawny-olive, lightly pencilled with black hairs. Dorsal fur (17 mm.) slate for two-thirds of length, tipped with clay colour. On sides of body yellowness fades and general colour is about smoke-grey, the fur being slaty at base, with lighter tips, the grey showing through. Line of demarcation between dorsal and ventral colouration fairly sharply marked and situated well down the sides of the body. Fur of ventral surface white to base. Crown of head as body; cheeks grey, upper lip white. Mystacial vibrissae very long (80 mm.) and numerous; dark-brown with lighter tips. Ear long; greyish-brown; clothed on outer surface with brownish hair, inner surface with a few silvery hairs. Tail longer than head and body; dark-brown on upper surface for from two-thirds to four-fifths of its length, tip and underside white; hairs fairly numerous, but not hiding scales except towards tip where they are much lengthened (18 mm.). Manus soiled white with a brown patch on the wrist extending more than half way down metacarpals; Phalanges white and well covered with adpressed white hair. Pes white; some specimens have brown mark along outer metatarsal; well clothed with white hair.

Skull.—All available skulls have occipital region missing. More lightly built than other Victorian member of genus. Front edge of zygomatic plate almost straight and quite vertical. Interorbital region with sharply-angled edges.

Teeth.—Incisors slender and narrow. Upper molars comparatively small; slightly diverging posteriorly.

Dimensions of Skin.—Head and body, 73 mm.; tail, 77 mm.; hind foot, 42 mm.; ear, 27 mm.

Dimensions of Skull.—Back of parietals to tip of nasals, 34 mm.; nasals, 15×5 mm.; interorbital breadth, 5.5 mm.; palate length, 21 mm.; breadth inside M^2 , 3.5 mm.; breadth outside M^2 , 7.8 mm.; palatal foramina, 7.8 mm.; diastema, 10.8 mm.; upper molars, 7.5 mm.

Type Locality.—South Australia.

There are nineteen Victorian specimens in the collection, all taken by Blandowski near the Murray-Darling junction. They do not differ in any feature from more recent Central Australian specimens.

Kreffft, who accompanied Blandowski during part of his expedition, records some interesting data regarding the habits of the White-tailed House-building Rat (*loc. cit.*). He says:

"This pretty little animal is nocturnal and gregarious. I have frequently taken from 8 to 10 out of a hollow tree, and tamed them so that they kept about the camp, mounting the supper table at tea-time for their share of sugar and damper. . . . It has been stated that the tail of this animal is nearly destitute of the long brushy hairs towards the tip, which are found in almost all species of this genus; this, however, is not the rule but the exception only, though specimens kept in captivity soon lose their long hairs, and frequently their tails also, if kept with other rodents."

Leporillus conditor (Gould).

Mus conditor Gould, Sturt's Expdn. Cent. Aust., i, p. 120, pl. i; and ii, app., p. 7, 1848.

Hapalotis conditor Gould, Mamm. Aust., iii, pl. vi, 1863; Krefft, Cat. Mamm. Coll. Aust. Mus., p. 65, 1864.

Conilurus conditor Ogilby, Aust. Mus. Cat., No. 16, Aust. Mamm., p. 118, 1892.

Leporillus conditor Troughton, Rec. Aust. Mus., xiv, p. 24, 1923; Wood Jones, Mamm. Sth. Aust., iii, p. 327, 1925.

General colour buffy-brown, lightly grizzled with black hairs. Dorsal fur slate for two-thirds of length, then yellowish-brown with darker tips. Sides of body lighter but same buffy hue. No line of demarcation between dorsal and ventral colouration. Ventral surface buffy-white; hair smoky at base, tipped with buffy-white, some grey showing through. Head as body; cheeks scarcely lighter, upper lip white. Mystacial vibrissae of moderate length (60 mm.); black. Ear large and rounded; outer surface dark-brown anteriorly, fading to yellowish on hinder edge and well clothed with adpressed hair, inner surface naked except towards the tip where there are a few buffy hairs. Tail less than head and body; whitish below, dark-brown above to the tip; hairs numerous but not sufficiently so to hide scales, not or scarcely lengthened at tip. Manus with dark-brown patch on carpus extending half-way down digits; well clothed with hair. Pes yellowish-white, a dark line on outer metatarsal extending to a patch on digits; well clothed with hair.

Skull.—Heavier than in the last species. The front edge of the zygomatic plate slopes forwards to its base instead of being vertical. Interorbital region without sharply-angled edges.

Teeth.—Heavier, but otherwise similar to those of last species.

Dimensions of Skin.—Head and body, 188 mm.; tail, 154 mm.; hind foot, 43 mm.; ear, 30 mm.

Dimensions of Skull.—Back of parietals to tip of nasals, 38 mm.; nasals, 16×4.8 mm.; interorbital breadth, 6 mm.; palate length, 23.5 mm.; breadth inside M^2 , 3.5 mm.; breadth outside M^2 , 9 mm.; palatal foramina, 10.5 mm.; diastema, 11.8 mm.; upper molars, 8.8 mm.

Type Locality.—Darling River, New South Wales.

The House-building Rat has apparently long been extinct in Victoria. Kreffft, writing in 1864, says:

"This animal has become exceedingly rare, and is only found in localities where it is not disturbed by sheep or cattle. I do not think it occurs south of the Murray, where, according to the Aborigines, it was found in large numbers years ago. The hut-like mounds of dry sticks which this rat uses in the construction of its habitation, may be frequently met with on the Murray Plains, but they are either uninhabited or occupied by *Haplotis apicalis*, a species always at war with the larger, and apparently stronger, though not so numerous, *Haplotis conditor*."

The rat still lives and builds its "wurlies" in South and Western Australia. Troughton (loc. cit.) gives a full account of its habits in those localities in his monograph of the genus.

Genus NOTOMYS Lesson 1842.

The genus contains a group of the Australian Jerboa Mice having a glandular organ in the gular area. They are comparatively small, and have lengthened hind feet on which the pads are reduced to three or four. The tail is long, with lengthened hairs towards the tip. Gland on throat sharply defined by silvery hair. Skull rounded and without ridges; anterior edge of zygoma root deeply concave and with a projecting point above. Teeth with no antero-internal cusp on molars.

Notomys mitchelli (Ogilby).

Dipus mitchelli Ogilby, Trans. Linn. Soc. Lond., xviii, p. 130, 1841.

Notomys mitchelli Thomas, Ann. Mag. Nat. Hist., (9), viii, p. 539, 1921; id., Ann. Mag. Nat. Hist., (9), ix, p. 315, 1922; Wood Jones, Rec. Sth. Aust. Mus., iii, p. 3, 1925; id., Mamm. Sth. Aust., iii, p. 339, 1925; Brazenor, Mem. Nat. Mus., Melb., No. 8, p. 78, 1934.

More than 30 specimens of Mitchell's Jerboa Mouse collected by Brandowski are in the National Museum, but no examples have since been recorded. They agree with Ogilby's material in the Australian Museum, Sydney, and were taken very close to the type locality.

General colour tawny-olive, darker on the mid-dorsal line. Dorsal fur (14 mm.) slate for a little more than half length, then tawny with dark tips, the latter becoming more pronounced at the hinder part of the body. Sides of body lighter, line of demarcation between dorsal and ventral colouration fairly sharp. Ventral fur basally grey for a little more than half length, with white tips. Head as body; cheeks lighter, upper lip white. Ears long, tips bluntly pointed; outer surface sparsely covered with dark brown hairs, inner surface with silvery adpressed hairs. Gular glandular area well defined by thick, silky, white hair. Tail brown above, white below to the tip; hairs of tip much lengthened. Manus and pes silvery-white. Pes long and narrow, with four pads, though in some specimens the hallucal pad is not well defined.

Skull.—Comparatively large for the size of the animal. Smooth and rounded. Anterior edge of zygomatic plate deeply concave with a projecting point above.

Teeth.—Incisors slender. Molars with no antero-internal cusp.

Dimension of Skin.—Head and body, 112 mm.; tail, 148 mm.; hind foot, 36 mm.; ear, 23.5 mm.

Dimensions of Skull.—Back of parietals to tip of nasals, 27 mm.; nasals, 10.5×3 mm.; interorbital breadth, 5 mm.; palate length, 14 mm.; breadth inside M^2 , 3.3 mm.; breadth outside M^2 , 6.3 mm.; palatal foramina, 5.5 mm.; diastema, 7 mm.; upper molars, 5 mm.

Type Locality.—Junction of Murray and Murrumbidgee Rivers.

No details of the habits of this species have been preserved, but allied forms construct burrows in which they make grass nests in typical murine fashion.

Notomys mitchelli macropus Thomas.

Notomys mitchelli macropus Thomas, Ann. Mag. Nat. Hist., (9), viii, p. 540, 1921; Wood Jones, Mamm. Stk. Aust., iii, p. 341, 1925; Brazenor, Mem. Nat. Mus., Melb., No. 8, p. 79, 1934.

This form of Mitchell's Jerboa Mouse is probably still living in north-western Victoria. It is greyer in colour, has longer fur, and slightly longer feet than the typical form.

General colour between avellaneus and wood-brown, but darkened on the dorsal surface by a grizzling of dark-tipped hairs. Dorsal fur (18 mm.) slate for two-thirds of its length, then pallid with dark tips. Sides of body lighter, with less demarcation between dorsal and ventral colouration than in typical form. Ventral fur grey for less than half its length, tipped with white. Head as body; cheeks lighter, upper lip white. Mystacial vibrissae very long (55 mm.); dark-brown with lighter tips. Ear long, more truly oval than in typical *mitchelli*; clothed on outer surface with hair same colour as body. Gular glandular area as in *mitchelli*. Tail greyish-brown above, white below; hairs of tip lengthened. Manus and pes white. Pes a little longer and stouter than in *mitchelli*. Four pads.

Skull and Teeth.—Similar to those of typical form.

Dimensions of Skin.—Head and body, 107 mm.; tail, 145 mm.; hind foot, 39 mm.; ear, 26 mm.

Dimensions of Skull.—Greatest length, 32.5 mm.; basal length, 27 mm.; greatest breadth, 17 mm.; nasals, 11.5×3 mm.; interorbital breadth, 5.5 mm.; palate length, 15 mm.; breadth inside M^2 , 4 mm.; breadth outside M^2 , 7.3 mm.; palatal foramina, 6 mm.; diastema, 8 mm.; upper molars, 5.3 mm.

Type locality.—Port Lincoln, South Australia.

Since the Australian Jerboa Mice were reviewed in this journal (loc. cit.) two additional specimens of *m. macropus* have been discovered in the Museum collection. Except that they are slightly warmer in general tone, being about wood-brown, they agree with the specimen described. One is an adult male, the other an immature female. No data as to precise habitat is preserved in either case.

In the early part of this year a very good description of a Jerboa Mouse was given to me by an observer who, for several minutes, watched an animal hopping on and around a log on the banks of a small creek near Natimuk, in the Wimmera district, western Victoria. Its colour was described as grey, and I have no doubt that it was an example of this subspecies.

The Murine population of Victoria cannot be dismissed without some mention of introduced species. Three of these occur. They are the Black Rat, *Rattus rattus* (with which is grouped its grey-coloured subspecies, the Alexandrine Rat, *R. rattus alexandrinus*), the Brown or Norway Rat, *R. norvegicus*, and the House Mouse, *Mus musculus*. The first and the last are as common, and more widely distributed throughout the State than any native species; at times they reach plague proportions and do incalculable damage to crops, etc. The two species of introduced *Rattus* may be distinguished from native rats by their shorter and more hispid fur. They have many times been redescribed in Australia, and the Black Rat has a list of nearly a dozen synonymous names.

Rattus novegicus Erxleben 1777.

A large, heavily-built rat with coarse, spiny fur. General colouration of dorsal surface brownish, individual hairs being slaty-grey at the base, then yellowish-brown with darker tips. Sides of body lighter. Ventral surface greyish-white, hair grey at base tipped with white. Ear thick and short; when laid forward will not reach the eye. Tail shorter than head and body; with large coarse scales, sparsely sprinkled with blackish-brown hairs. Manus and pes brown.

Skull.—Large and robust, the braincase long and narrow. In fully adult specimens the supraorbital ridges, which extend backwards to the interparietal, are almost parallel, and the length of the parietal is greater than the width of the interparietal measured across the skull.

Teeth.—Compared with native Victorian species the molar teeth are small. Incisors robust.

Dimensions of Skin (from flesh).—Head and body, 217 mm.; tail, 180 mm.; hind foot, 37 mm.; ear, 18 mm.

Dimensions of Skull.—Greatest length, 46 mm.; basal length, 43 mm.; greatest breadth, 25.5 mm.; nasals, 17×4.5 mm.; interorbital breadth, 6.5 mm.; palate length, 25.5 mm.; breadth inside M^2 , 5.5 mm.; breadth outside M^2 , 10 mm.; palatal foramina, 8 mm.; diastema, 14 mm.; upper molars, 6.8 mm.

Type Locality.—Northern Europe.

In Victoria the Brown Rat is more or less confined to towns and human habitation. It is essentially a burrower, or lives underground in drains or sewers. Omnivorous in diet, it prefers animal food, and is a particular pest in hide warehouses, where it does much damage.

Rattus rattus Linnaeus 1758.

The Black Rat is more lightly built than the last species, it has a longer tail, and its fur is not so coarse.

General colour varies from slaty-grey to black on the back, the ventral surface being scarcely lighter. The animal has a slender appearance, with a long head and pointed muzzle. Ear thin and membranous, when laid forward almost covers the eye. Tail long and tapering; considerably longer than head and body. Manus and pes dark in colour, on the underside as well as above.

Skull.—Less massive in appearance than that of the Brown Rat. The braincase is wider, and the supraorbital ridges are not parallel but bowed outwards. The length of the parietals is not as great as the width of the interparietals.

Teeth.—Size approximately as in the last species.

Dimensions of Skin (from flesh).—Head and body, 189 mm.; tail, 261 mm.; hind foot, 36 mm.; ear, 24 mm.

Dimensions of Skull.—Greatest length, 45.5 mm.; basal length, 41 mm.; greatest breadth, 22 mm.; nasals, 16×4.5 mm.; interorbital breadth, 7 mm.; palate length, 24.8 mm.; breadth inside M^2 , 4.5 mm.; breadth outside M^2 , 9 mm.; palatal foramina, 8 mm.; diastema, 12.5 mm.; upper molars, 6.5 mm.

Type Locality.—Northern Europe.

Rattus rattus alexandrinus Geoffroy 1803.

General form as in typical species, but colour varies from greyish-brown to speckled ochraceous-buff above, contrasted with greyish-white to cream on the ventral surface. Ear and tail similar to Black Rat. Manus and pes brown to buff, usually conforming to the general colouration of the animal.

Skull, Teeth and Dimensions.—As in typical form.

Type Locality.—Southern Europe.

The Black and Alexandrine Rats have spread throughout almost the length and breadth of Victoria. They are met with in uninhabited bush, and in the centre of the busiest cities. Though they sometimes construct burrows, they are not essentially fossorial but often live in trees, where they make nests or take over those originally built by birds. In buildings they live in walls and ceilings. They prefer a vegetable diet, play havoc in grain warehouses, and in orchards often climb trees to eat the growing fruit. They are also ships' rats and are the hosts of the plague flea.

In the towns of Northern Europe the Black Rat has been driven out and largely replaced by the Brown or Norway Rat, but, strangely, the exact opposite has taken place in Melbourne. Thirty years ago the rat population of this city was composed entirely of *R. norvegicus*, and the Black Rat was of such rarity that any specimens captured were considered worthy of preservation in the museum. About four years ago the writer investigated the present-day rat population of Melbourne, and, through the kindness of the City Health Officer, Dr. Dale, examined all rats caught by the City ratcatchers for a period of several weeks. About 500 adult specimens were individually examined, measured, and variation noted. Only the general facts are quoted here as an illustration of the present-day dominance of the smaller species.

Of the rats caught within the City area of Melbourne, 87.5 per cent. were *R. rattus*; of *R. rattus* the black form was represented by only 10 per cent, the remainder being grey. The colour forms do not grade, though the fact of interbreeding was verified, the two forms being present in a single litter of young.

In Europe and America the colour forms remain more or less true to geographical conditions. The black form is northern (cool climate), the grey southern (warm climate). In Australia the two forms intermingle, though in view of the great percentage of greys in the cooler south it would be interesting to know whether, if at all, the percentage varies in the warmer climate of northern cities.

Victoria has not been greatly troubled with rat plagues, though other States, principally northern, have had many occurrences.

Mus musculus Linnaeus 1758.

The European House Mouse has invaded every part of Victoria, and is usually known in the bush as the Field Mouse.

Size small. General colour varies from greyish-brown to yellowish-brown on the dorsal surface, and from brownish-grey to white below. The majority show little contrast between the upper and lower surfaces. Ear fairly large. Tail about as long as head and body. Manus and pes buffy-white, sparsely clothed with brownish-white hairs.

Skull.—Comparatively broad and flat. Wide in the interorbital region. Anterior edge of zygomatic plate sloping gently backwards towards its base.

Teeth.—First molar large, its length more than M^2 and M^3 combined. Wearing surface of upper incisors notched.

Dimensions of Skin (from flesh).—Head and body, 74 mm.; tail, 82 mm.; hind foot, 17.5 mm.; ear, 11.5 mm.

Dimensions of Skull.—Greatest length, 22.3 mm.; basal length, 19.5 mm.; greatest breadth, 12 mm.; nasals, 7.5×2.3 mm.; interorbital breadth, 4 mm.; palate length, 11.5 mm.; breadth inside M^2 , 3 mm.; breadth outside M^2 , 4.5 mm.; palatal foramina, 5 mm.; diastema, 5.5 mm.; upper molars, 3 mm.

Type Locality.—Europe.

The teeth characters mentioned above are a simple means of separating the European House Mouse from the native mice. Molar teeth of the latter are graduated in size, the second being only a little smaller than the first, and the incisors have a true chisel edge. If the upper lip of the House Mouse be lifted, the notched incisors are easily seen.

Many mouse plagues have occurred in Victoria, and in every case they have consisted of this species. Periodically, and probably in relation to suitable weather conditions, the fertility of the mice increases tremendously, and their numbers become many hundreds of times more than normal. Food supply becomes inadequate, and they commence a migratory movement, usually towards the south. Wood Jones also points out (*Mamm. Sth. Aust.*, iii, p. 322) that, apart from migration, the wave of increased fertility also moves progressively, and has been known to affect an island colony to which the mainland animals could have no access. At the height of the plague millions of mice are on the move. They are preyed upon by other mammals and birds, and are trampled in hundreds under the feet of agricultural workers. Finally starvation and disease set in, and, as suddenly as they increased, numbers return to normal. The amount of damage and the monetary loss to the State caused by such incidents cannot be calculated, but it must amount to a huge sum.

EXPLANATION OF PLATES.

Skulls; *a*, dorsal; *b*, lateral; *c*, ventral view. Pes, *d*. Upper Molars, *e*.

Plate XIII.

- Fig. 1. *Hydromys chrysogaster* Geoffroy.
- Fig. 2. *Rattus assismilis* (Gould).
- Fig. 3. *R. greyi ravus* subsp. nov.
- Fig. 4. *R. lutreolus* (Gray).

Plate XIV.

- Fig. 1. *Pseudomys (Leggadina) novae-hollandiae* (Waterhouse).
- Fig. 2. *P. (Thetomys) gouldi* (Waterhouse).
- Fig. 3. *P. (Gyomys) fumeus* Brazenor.
- Fig. 4. *P. (Gyomys) desertor* Troughton.

Plate XV.

- Fig. 1. *Mastacomys fuscus* Thomas.
- Fig. 2. *Leporillus apicalis* (Gould).
- Fig. 3. *L. conditor* (Gould).
- Fig. 4. *Notomys mitchelli macropus* Thomas.

Plate XVI.

- Fig. 1. *Notomys mitchelli* (Ogilby).
- Fig. 2. *Mus musculus* Linnaeus.
- Fig. 3. *Rattus rattus* Linnaeus.
- Fig. 4. *R. norvegicus* Erxleben.

A SYSTEMATIC REVISION OF THE AUSTRALIAN THORNBILLS.

By George Mack,

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No other group of Australian passerine birds has provided as many systematic difficulties as the Tits or Thornbills. This has resulted mainly from the paucity of specimens available to most authors in the past, and to the introduction over a period of years of many unnecessary names. The H. L. White Collection of Australian birds has greatly minimized the first of these difficulties, and it is the basis of the present effort to clarify the confusion in nomenclature; this collection has been supplemented by specimens in the general collection of the National Museum and by some excellent material kindly sent on loan by the Queensland, Australian, Tasmanian, South Australian and Western Australian Museums. About 700 specimens have been examined.

Within the genus *Acanthiza* as here defined Mathews alone has proposed about fifty names, more than half of which he has already consigned to synonymy (Syst. Av. Aust., 1930). In the present revision it has been necessary to retain only eleven of Mathews' names, two of which replace preoccupied names. The number of genera and forms recognized by various authors during the past thirty years may be seen at a glance in the following table:

	Genus	Subg.	Species	Subsp.
North, Aust. Mus. Spec. Cat., i, 1901-04 ..	2	—	12	?
Mathews, Handlist, 1908	1	—	21	—
Mathews, Checklist, 1913	3	—	13	48
Mathews, Birds of Aust., ix, 1922	3	1	10	70
Mathews, Syst. Av. Aust., 1930	1	—	10	53
Campbell, Emu, xxv, 1925	2	—	17	?
R.A.O.U. Checklist (2nd ed.), 1926	1	2	17	—
Present paper	1	—	10	34

Since the completion in manuscript of this paper, Campbell has published notes and maps showing the distribution of the seventeen species recognized by him (Emu, xxxv, p. 324).

Except on the east coast where three species range northwards almost to the 15th parallel of latitude, the distribution of Australian Thornbills is chiefly extra-tropical, the approximate northern limit being the 20th parallel of south latitude.

Of the three species which occur in Tasmania, only *A. ewingi* is absent from the mainland, and it is worthy of note that it is the only species of the genus represented in recent collections from King and Flinders Islands, Bass Strait.

To provide a basis for comparison between races it has been necessary to describe in full a typical example of each species; accordingly the typical form in each instance is included first irrespective of its geographical position.

Colour terms are from Ridgway's *Color Standards and Nomenclature*, and all measurements are in millimetres.

Genus ACANTHIZA Vigors and Horsfield.

Acanthiza Vigors and Horsfield, Trans. Linn. Soc., xv, 1927, p. 244.

Type by original designation, *Motacilla pusilla* White.

Geobasileus Cabanis, Mus. Hein., i, 1851, p. 32. Type, by monotypy, *Saxicola chrysorrhoa* Quoy and Gaimard.

Milligania Mathews, Aust. Av. Rec., i, 1912, p. 112. Type, by original designation, *Acanthiza robustirostris* Milligan.

Subacanthiza Mathews, Birds of Aust., ix, 1922, p. 449. Type, by monotypy, *Acanthiza lineata* Gould.

The original description of *Geobasileus* is not available to me, but authors who have accepted that genus have stressed the difference in size and wing formula, and the bright colour of the rump compared with *Acanthiza*. The difference in size is slight, *chrysorrhoa* having a longer wing and bill, but shorter tail and tarsus compared with the type of *Acanthiza*, and the only difference in wing formula is that in *chrysorrhoa* the third primary approaches nearer in length to the fourth than in *pusilla*. The main distinguishing feature of *Geobasileus* is the distinct colour of the rump, but this does not warrant generic rank. Indeed, a striking difference in colour of rump is characteristic of other species of the group, and is a trenchant subspecific character between races of *pusilla*. The retention of *Geobasileus* on this single feature has led to peculiar divisions of the species by some authors. Because of the light buff colour of the rump it has been customary to refer *reguloides* to *Geobasileus*, and for many years Mathews included *hedleyi* (= *A. iredalei hedleyi*) as a species of that genus, while retaining *iredalei* in *Acanthiza*.

The two species for which *Milligania* and *Subacanthiza* were erected in no way differ from *Acanthiza*, and the author of both names recently retained only *Acanthiza* where formerly he accepted three genera and one subgenus (Syst. Av. Aust., p. 601).

ACANTHIZA PUSILLA (White).

As a result of the wide distribution of this species, in which it is approached only by *chrysorrhoa* within the genus, marked racial differences are apparent in a series of specimens. In some instances these differences have been accorded specific rank and, principally owing to lack of material, the tendency to follow early workers in this respect persists. North (Aust. Mus. Spec. Cat., No. 1, i, 1904, p. 268 *et seq.*) remarked on the obvious similarity of some species, and Mathews relegated some to the status of subspecies. In this paper *katherina*, *apicalis*, *whitlocki* and *albiventris* (with *hamiltoni* as a synonym), all of which are accorded specific rank in the R.A.O.U. Checklist (1926), are included as races of *pusilla*.

Acanthiza pusilla pusilla (White).

Motacilla pusilla White, Journ. Voy. New South Wales, 1790, p. 257; New South Wales.

Malurus maculatus Vieillot, Nouv. Dict. d'Hist. Nat., xx, 1818, p. 215; New South Wales.

Acanthiza pusilla bunya Mathews, Bull. Brit. Ornith. Club, xl, 1920, p. 105, Bunya Mountains, S. Queensland.

Acanthiza pusilla dawsoneensis Campbell, Emu, xxii, 1922, p. 63; Dawson River, Queensland.

Range.—From vicinity of Sydney, New South Wales, north at least to the Dawson River, south-eastern Queensland (coastal).

Specimens Examined.—Twenty from the following localities: *Queensland*: Dawson River (type of *dawsoneensis*), Coomera River, Brisbane. *New South Wales*: Clarence River, near Scone, Tarana, Lithgow, Mulgoa, various localities near Sydney.

Measurements.—Twenty adult specimens of both sexes: wing, 48-53 (50.8); tail, 40-46 (42.9); exposed culmen, 8-9 (8.7); tarsus, 17-19 (17.9).

Male.—General colour of dorsal surface buffy olive; forehead tawny olive, each feather tipped blackish brown, with lighter curved subterminal band indicated; feathers of lores and below eyes greyish, tipped and margined blackish brown; ear-coverts buffy olive with lighter shafts; wings fuscous, margins of both upper-coverts and quills brownish olive, lighter on distal part of primaries; upper tail-coverts snuff brown; tail saccardo's umber, suffused snuff brown at base, and crossed by a broad subterminal band of black, which is reduced to black spots on two central feathers; feathers of chin, throat and breast white with dark grey bases and distinctly margined brownish black, giving a striated appearance; abdomen white, tinged olive-buff, merging into dark olive-buff on flanks; under tail-coverts pinkish buff; axillaries and under wing-coverts white, the latter tipped fuscous; inner margins of wing-quills cartridge buff. "Bill blackish brown; eyes red; feet dark brown."

Female.—Similar to male.

As the type locality is close to the southern extremity of the range of this form, some birds from the vicinity of Sydney resemble the adjoining race to the south (*macularia*), but specimens from south Queensland and localities north of Sydney are typical. The type and only specimen of *dawsonensis* differs from *pusilla* in its lighter lower under surface, and in having a narrow white margin towards the tip of inner web of lateral tail feathers, thus approaching *albiventris*. In depth of tail band and general upper colouration it is similar to *pusilla* and possibly the differences noted are the result of intergradation with *albiventris*, but adequate series from coastal eastern Queensland are essential for an understanding of the relationship of the three races of *pusilla* and other species in the vicinity of Rockhampton.

Acanthiza pusilla katherina De Vis.

Acanthiza katherina De Vis, Ann. Queensld. Mus., No. 6, 1905, p. 43;
Bellenden Ker Range, Queensland.

Range.—From about Cairns to south of Cardwell, north-eastern Queensland.

Specimens Examined.—Fifteen from Bellenden Ker Range, Ravenshoe, and Herberton district.

Measurements.—Five specimens of both sexes: wing, 51-55 (53·2); tail, 42-44 (42·8); exposed culmen, 9·9-5 (9·2); tarsus, 17-18 (17·2).

Subspecific Characters.—Differs from all other races of *pusilla* in the rich greenish colour of the dorsal surface, olive to dark olive; feathers of forehead deep olive-buff, rather than tawny as in typical *pusilla*; dark throat striations much less prominent, and remainder of ventral surface yellowish, deep olive-buff to dark olive-buff on flanks.

Although a distinct and easily recognized form, specific separation of *katherina* is not warranted. The lack of material noted under typical *pusilla* applies equally to this race, and while it is probable that the range of *katherina* extends considerably south of Cardwell, specimens have yet to be obtained.

Acanthiza pusilla macularia (Quoy and Gaimard).

Saxicola macularia Quoy and Gaimard, Voy. Astrol., i, 1830, p. 199;
Western Port, Victoria.

Acanthiza pusilla samueli Mathews, Aust. Av. Rec., ii, 1913, p. 76;
Myponga, South Australia.

Acanthiza pusilla cambrensis A. G. Campbell, Emu xxii, 1922, p. 63;
Cape Jervis, South Australia.

Range.—From south-eastern New South Wales, through southern Victoria to the vicinity of Adelaide, South Australia.

Specimens Examined.—Twenty-one from the following localities: *Victoria*: Marlo, near Port Albert, Fernshaw, Phillip Island, Somerville, Kilsyth, Bayswater, vicinity of Melbourne, Port Fairy. *South Australia*: Salt Creek, Coorong, twenty miles west of Port Victor.

Measurements.—Twenty-one adult specimens of both sexes: wing, 48-53 (51); tail, 40-46 (44.5); exposed culmen, 8-9 (8.7); tarsus, 18-20 (18.8).

Subspecific Characters.—Near to typical *pusilla* but darker, more brownish above and on flanks; light subterminal band of forehead feathers more distinct. Dorsal surface brownish olive; flanks buffy brown.

South Australian specimens from near Port Victor are typical *macularia*. The single example from the Coorong, however, exhibits distinct evidence of intergradation with *albiventris* which ranges almost to the coast in that part of South Australia only.

Acanthiza pusilla diemenensis Gould.

Acanthiza diemenensis Gould, Synop. Birds of Aust., 1838, pl. 59; Tasmania.

Range.—Tasmania.

Specimens Examined.—Seven from the following localities: Hobart, Sandford, Bagdad, Launceston.

Measurements.—Seven adult specimens of both sexes: wing, 51-56 (54.1); tail, 39-48 (42.5); exposed culmen, 9-10 (9.2); tarsus, 18-19.5 (18.4).

Subspecific Characters.—Closely resembling the typical form in colouration, but tinged greyish olive above, and tips of inner web of most tail feathers narrowly margined white. The bill and wing averages slightly longer than *A. p. pusilla*.

Size has been stressed as the chief characteristic of *diemenensis*, and while it averages slightly more in length of bill and wing than *A. p. pusilla*, it is similar to some races in all measurements. The greyish olive colour of the back, and the narrow white margin at tip of inner web of some tail feathers appear more definite characters.

Acanthiza pusilla archibaldi Mathews.

Acanthiza magnirostris A. J. Campbell, Emu, ii, 1903, p. 202; King Island. (Not *Acanthiza magnirostris* Gould, Synop. Birds of Aust., 1838, pl. 60.)

Acanthiza archibaldi Mathews, Nov. Zool., xvii, 1910, p. 501; new name for *Acanthiza magnirostris* A. J. Campbell.

Range.—King Island, Bass Strait.

Specimens Examined.—Three, including type of *magnirostris* A. J. Campbell.

Measurements.—

	Wing	Tail	Exposed Culmen	Tarsus
♂ (type)	53	40	13	18
♂ imm.	53	41	12	18
♀ imm.	55	43	12	18

Subspecific Characters.—Similar to *diemenensis* in colouration, but differing from all forms in the great length of bill.

The three specimens from which A. J. Campbell described this race are the only available representatives of *pusilla* from King Island. The single adult (type) is in very worn plumage which accounts for the greater length of wing and tail of the immature female. The outstanding feature of this race is the extraordinary long bill which is accepted as characteristic only in view of the fact that both immature specimens exhibit the same feature.

During a recent visit to King Island no specimen of this form was seen, although I made an intensive search. On the other hand *Acanthiza ewingi* was fairly numerous.

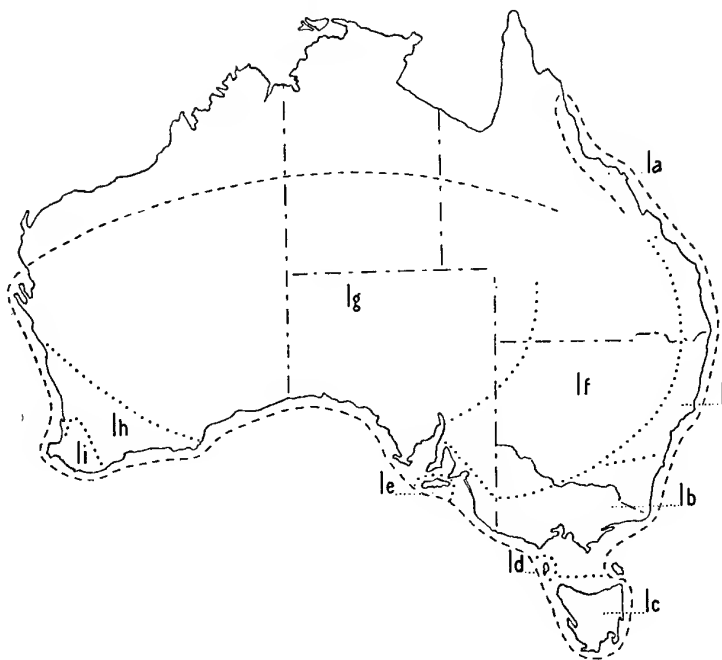


FIG. 1. DISTRIBUTION.

- 1, *Acanthiza pusilla pusilla*; 1a, *A. p. katherina*; 1b, *A. p. macularia*;
 1c, *A. p. diemenensis*; 1d, *A. p. archibaldi*; 1e, *A. p. zietzi*;
 1f, *A. p. albiventris*; 1g, *A. p. whitlocki*; 1h, *A. p. apicalis*; 1i, *A. p. leeuwinensis*.

Acanthiza pusilla zietzi North.

Acanthiza zietzi North, Aust. Mus. Spec. Cat., i, 1904, p. 271; Kangaroo Island, South Australia.

Acanthiza halmaturina A. G. Campbell, Emu, v, 1906, p. 141; Kangaroo Island, South Australia.

Range.—Kangaroo Island, South Australia.

Specimens Examined.—Twelve from the following localities: Queenscliff (type of *zietzi*), Vivonne Bay, Kingscote, and type of *halmaturina* labelled "Kangaroo Island."

Measurements.—Eleven adult specimens of both sexes: wing, 47-53 (50.7); tail, 40-46 (44); exposed culmen, 8-10 (8.9); tarsus, 18-20 (19).

Subspecific Characters.—Darker throughout than any other race of *pusilla*. Dorsal surface suffused dark greyish olive and the flanks greyish olive to drab.

The dull, dark colouration of *zietzi* makes it an easily recognized race.

Acanthiza pusilla albiventris North.

Acanthiza pyrrhopygia Gould, Birds of Aust., iii, 1847, pl. 58; Murray River, South Australia. (Not *Acanthiza pyrrhopygia* Vig. and Horsf., Trans. Linn. Soc., xv, 1827, p. 227).

Acanthiza albiventris North, Aust. Mus. Spec. Cat., i, 1904, p. 276; Dubbo, New South Wales.

Acanthiza albiventris hamiltoni Mathews, Bull. Brit. Ornith. Club, xxvii, 1911, p. 97; New South Wales, error = Coonalpyn, South Australia.

Acanthiza pusilla cobborensis Mathews, Birds of Aust., ix, 1922, p. 412; Cobbora, New South Wales.

Acanthiza pusilla lingerandi Mathews, *ib.* p. 430; Lingerandi, Victoria.

Range.—South-central Queensland, inland New South Wales, north-western Victoria and adjoining area of South Australia, west to Yorke Peninsula, and possibly to extreme south of Eyre Peninsula, South Australia.

Specimens Examined.—Twenty-nine from the following localities: *Queensland*: Chinchilla. *New South Wales*: Gunnedah, Manilla, Cobbora, Narrabri. *Victoria*: Kow Plains. *South Australia*: Fifty miles south of Pinaroo, Coombe, Wellington, Winganin, Murray River.

Measurements.—Twenty-nine specimens of both sexes: wing, 49-55 (51.7); tail, 40-47 (44); exposed culmen, 8.9-9.5 (8.9); tarsus, 17-19.5 (18.3).

Subspecific Characters.—Differs from all coastal and insular races in being paler, drab to hair brown above, whiter on the under surface, and feathers of forehead are mainly blackish brown with distinct white or buffy white sub-terminal band. Distinguished from all forms of the species by the conspicuous russet to tawny colour of upper tail-coverts and outer margins of basal portion of tail feathers. Equalled only by *whitlocki*, the other, more pallid inland race, in depth of tail-band (12-14 mm.), which is more distinct on central tail feathers, and in having a large white spot at tip of inner web of lateral tail feathers.

The striking russet colour of the upper tail-coverts and the greater depth of black tail-band are characters the specific worth of which cannot be maintained when a good series of all races of *pusilla* is examined. Specimens from the probable area of intergradation with *whitlocki* are lacking, but those from the southern part of the range approach *macularia* in being darker above and on the flanks. One example from Wingamin, South Australia, which has been compared with the type of *A. pyrrhopygia* Gould by Dr. Witmer Stone and declared similar, closely resembles *macularia* in its darker colouration, particularly the flanks, which are buffy brown, and the depth of tail-band is less than in typical *albiventris* but greater than *macularia*.

Individual variation is exemplified in a series of twelve birds from Cobbora, New South Wales, close to Dubbo, the type locality of *albiventris*. In some specimens the lower under surface, including under tail-coverts, is white except for a tinge of pinkish buff on the flanks, and there are various stages up to specimens with deeply-coloured flanks, dark olive buff to buffy brown, and pinkish buff under tail-coverts. There is similar, though not so notable, variation in the colour of upper parts, and failure to recognize these differences as individual or, in part, the result of worn plumage, has been the cause of much confusion. North named those with light, almost white, lower under surface *albiventris*, and Mathews named Cobbora specimens with rich coloured under surface *cobborensis*; those from the south showing an approach to *macularia* in colouration were named *hamiltoni* (= *pyrrhopygia* Gould) of which *lingerandi* is a pure synonym. Six specimens of the same series were listed by Campbell (Emu, xxv, p. 262 and 265), three as "*Acanthiza pyrrhopygia* Gould" and three as "*A. albiventris* North," but in the distributional maps recently published by that author, only "*A. albiventris*" is shown as inhabiting that area (Emu, xxxv, p. 324).

Acanthiza pusilla whitlocki North.

Acanthiza whitlocki North, Vict. Naturalist, xxvi, 1909, p. 55; Lake Way, Western Australia.

Acanthiza pusilla venus Mathews, Nov. Zool., xviii, 1912, p. 348; Venus Bay, Eyre Peninsula, South Australia.

Acanthiza tanami Mathews, *ib.* p. 349; Tanami, Central Australia.

Acanthiza pusilla arno Mathews, Aust. Av. Rec., ii, 1912, p. 44; Arno Bay, Eyre Peninsula, South Australia.

Acanthiza pusilla consobrina Mathews, *ib.*; Leigh's Creek, South Australia.

Acanthiza pusilla jayi Mathews, Aust. Av. Rec., ii, 1914, p. 98; Macdonnell Ranges, Central Australia.

Acanthiza pusilla peroni Mathews, Bull. Brit. Ornith. Club, xxix, 1918, p. 23; Peron Peninsula, Western Australia.

Acanthiza pusilla nullaborensis H. L. White, Emu, xxi, 1922, p. 164; Zanthus, Western Australia.

Acanthiza apicalis crema A. G. Campbell, Emu, xxii, 1922, p. 64; Kychering, South Australia.

Acanthiza pusilla dundasi Mathews, Birds of Aust., ix, 1922, p. 431; Lake Dundas, Western Australia.

Range.—Interior of the continent from south-western Queensland and extreme western New South Wales, west to coastal mid-western Australia; to Tanami in the north and Eyre Peninsula in the south.

Specimens Examined.—Forty-nine from the following localities: *Central Australia*: Powell's Creek, Hermannsburg, Mission Plain, Palm Valley. *South Australia*: Everard Ranges, Moorilyanna, McDouall Peak, Lake Gairdner, Gawler Ranges, Port Broughton, Iron Knob, Nonning, Mt. Hope, Wilcherry, Coffin's Bay Peninsula, Kychering (type of *A. apicalis crema*), Ooldea. *Western Australia*: Naretha (type of *nullaborensis*), Zanthus, Kalgoorlie, Lake Way, Yalgoo, Shark Bay, Peron Peninsula, Sullivan's Creek, Ebano, Yandanooka, Morewa.

Measurements.—Forty-five adult specimens of both sexes: wing, 48-55 (51.9); tail, 42-50 (45.4); exposed culmen, 8.5-10 (9); tarsus, 18-20 (18.8).

Subspecific Characters.—Much paler than all other races of *pusilla*. General colour above light greyish olive; upper tail-coverts snuff brown, and this colour does not extend on to outer margins of tail feathers; lower ventral surface white, faintly tinged pinkish buff on flanks and under tail-coverts; feathers of forehead blackish brown with light, almost white, subterminal bands as in *albiventris* with which this race agrees in depth of tail-band and extent of white on inner webs of lateral tail feathers.

If consideration had been given to the general similarity of environmental conditions throughout the interior of Australia the synonymy of this form would not be so extensive. It would appear that even Mathews has realized the uselessness of most of the above names for he has since consigned six of them, including five of his own, to synonymy, although in so doing no proper understanding is shown of faunal areas in Australia (Syst. Av. Aust., p. 603).

In the series examined individual variation is apparent. Most birds from Eyre Peninsula, in the south, are slightly darker, deeper grey above and more buffy on the flanks, but these can be matched by occasional specimens from central and mid-west Australia. Three examples from the extreme south-east of Eyre Peninsula have the upper parts more brownish and the upper tail-coverts tinged reddish brown, thus approaching *albiventris* and it is possible that more material may prove the presence of that race in the extreme south of

Eyre Peninsula. The single specimen from Kycherling, South Australia, described by A. G. Campbell under *A. apicalis erema*, is immature and in poor condition, but obviously is to be referred here.

Acanthiza pusilla apicalis Gould.

Acanthiza apicalis Gould, Birds of Aust., iii, 1847, pl. 57; Swan River, Western Australia.

Range.—South-west Western Australia, approximately west of a line between Geraldton and Israelite Bay, except extreme south-west.

Specimens Examined.—Thirty from the following localities: Doodlakine, Kellerberrin, Guildford, Perth, Kelmscott, Kalamunda, Mandurah, Dumbleyung, Gnowangerup, Broome Hill, Tenterden, Gordon River, Stirling Ranges.

Measurements.—Thirty adult specimens of both sexes: wing, 49-54 (51·7); tail, 43-50 (46·5); exposed culmen, 8·5-9·5 (8·9); tarsus, 17·5-19·5 (18·6).

Subspecific Characters.—Resembling *whitlocki* but darker above, hair brown tinged buffy olive, and upper tail-coverts buffy to olive brown; much darker, dark olive-buff to buffy brown on flanks and under tail-coverts. Extent of white at tips of inner web of tail feathers less than in *whitlocki* and *albi-ventris*, and tail-band (8-10 mm.) intermediate in depth between these two inland forms (12-14 mm.) and remaining coastal and insular races (6-7 mm.).

In colouration and depth of tail-band specimens from the north and south of the range of this form approach *whitlocki* and *leeuwinensis* respectively, thus affording ample evidence of intergradation.

Acanthiza pusilla leeuwinensis A. G. Campbell.

Acanthiza pusilla leeuwinensis A. G. Campbell, Emu, xxii, 1922, p. 63; Wilson's Inlet, Western Australia.

Acanthiza pusilla northi Mathews, Birds of Aust., ix, 1922, p. 431; Wilson's Inlet, Western Australia.

Range.—Forest country of extreme south-west Western Australia.

Specimens Examined.—Twenty-nine from the following localities: Albany, Torbay, Denmark, Wilson's Inlet (type of *leeuwinensis*), Irwin's Inlet, Bald Island, Augusta, Ellensbrook, Cape Naturaliste, Bunbury, Harvey River, Wandering.

Measurements.—Twenty-eight adult specimens of both sexes: wing, 48-55 (50·8); tail, 42-53 (45·3); exposed culmen, 8·5-9·5 (9); tarsus, 18·5-20 (18·8).

Subspecific Characters.—This race differs from all other forms in the rich brownish colour of the upper parts, flanks, and under tail-coverts. It is similar to other coastal and insular races in depth of tail-band (6-7 mm.). Dorsal surface olive brown; feathers of forehead with buffy brown subterminal bands; upper tail-coverts snuff brown; flanks and under tail-coverts clay colour to tawny-olive.

The similarity of conditions within the range of this race and *A. p. macularia* is reflected in the resemblance of the two forms. Typical *leeuwinensis* is sharply distinct from the adjoining *apicalis* but some specimens examined afford clear evidence of intergradation.

ACANTHIZA EWINGI Gould.

Acanthiza ewingi Gould, Birds of Aust., iii, 1844, pl. 55; Tasmania.

Acanthiza rufifrons Campbell, Emu, ii, 1903, p. 203; King Island, Bass Strait.

Acanthiza dovei Mathews, Birds of Aust., ix, 1922, p. 415; Mount Arthur, Tasmania. *Nom. nud.*

Range.—Tasmania, King and Flinders Islands, Bass Strait.

Specimens Examined.—Seventeen from the following localities: *Tasmania*: Hobart, Arre River, Launceston. *King Island*: type of *rufifrons*, near Currie, Surprise Bay, Naracoopa, Sea Elephant River, Yambacooa. *Flinders Island*: near Whitemark.

Measurements.—Seventeen adult specimens of both sexes: wing, 51-55 (52.6); tail, 45-50 (46.5); exposed culmen, 8-10 (9); tarsus, 19-21 (20).

Male.—Forehead from tawny-olive to snuff brown, each feather narrowly tipped blackish brown; remainder of dorsal surface light brownish olive; lores, above and below eyes, and ear-coverts grey to brownish grey, each feather narrowly margined brown; wing quills fuscous; upper wing-coverts fuscous black, and all, except outermost greater coverts broadly tipped or margined light brownish olive on outer web; outer web of outermost five or six primaries basally snuff brown, forming a conspicuous patch, distally becoming olive then whitish; outer web of remainder of primaries and secondaries basally blackish, distally becoming light brownish olive; upper tail-coverts snuff brown; tail drab, suffused snuff brown at base, crossed by a broad, subterminal band of black, indistinct on central feathers, and some of the lateral feathers narrowly tipped white on inner margin; upper portion of ventral surface greyish white, each feather with indistinct brownish margins; lower portion of ventral surface white, tinged buffy olive on flanks; under tail-coverts white; axillaries, under-wing coverts, and inner margin of wing-quills white. "Eyes red; feet greyish flesh-colour." Bill dark brown, paler at base of lower mandible.

Female.—Similar to male.

For many years the status and range of *ewingi* have been in doubt. Consigned by Gould (Handb. Birds of Aust., i, 1865, p. 365) to the synonymy of *A. diemenensis* (= *A. pusilla diemenensis*) most authors since have accorded it specific rank, but Mathews included it as a subspecies of *pusilla* confined to high altitudes in Tasmania. However, all Tasmanian specimens available to me are from coastal localities where *A. pusilla diemenensis* also is common, and recently, examples of *ewingi* were obtained from both King Island, the habitat of *A. pusilla archibaldi* (= *magnirostris* Campb.), and Flinders Island,

Bass Strait. Thus, it is clear that *ewingi* is not confined to the mountainous country of Tasmania, but is found throughout the range of two races of *pusilla*, and in view of the marked and constant difference in colouration between it and all forms of *pusilla*, specific rank is plainly warranted.

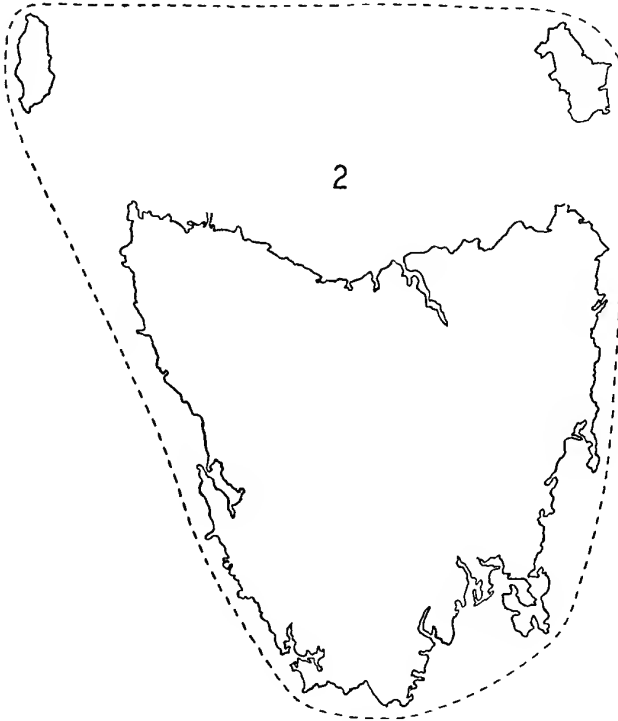


FIG. 2. DISTRIBUTION.
2, *Acanthiza ewingi*.

Compared with any race of *pusilla*, this species differs in lacking any indication of a light subterminal band on forehead feathers; in having a conspicuous snuff brown wing patch, bounded on two sides by fuscous black; in colour of ventral surface, the upper part of which is greyish, without distinct darker striations, and the lower portion is more clearly white with pure white under tail-coverts, in marked contrast to the buff under tail-coverts of *pusilla*. In dimensions it averages more in length of tarsus.

The single specimen from King Island for which A. J. Campbell proposed the name *rufifrons* is typical *ewingi*.

There are numerous smaller islands in Bass Strait and near the coast of Tasmania where *ewingi* and the preceding species are probably present, but definite records are wanting.

ACANTHIZA REGULOIDES Vigors and Horsfield.

Three forms, long considered worthy of recognition, appear admissible.

An unusual feature of the distribution both of this species and of *A. chrysorrhoa* is that only typical examples have been obtained at Cobbora, which lies west of the eastern coastal range. The Hunter River valley forms a break in the mountainous country in that area, but the vicinity of Scone, on the Hunter River, is the normal western limit of the range of coastal forms.

Acanthiza reguloides reguloides Vigors and Horsfield.

Acanthiza reguloides Vig. and Horsf., Trans. Linn. Soc., xv, 1827, p. 226; Parramatta, New South Wales.

Geobasileus reguloides tarana Mathews, Emu, xiv, 1914, p. 60; Tarana, New South Wales.

Geobasileus reguloides cobbora Mathews, Aust. Av. Rec., ii, 1915, p. 130; Cobbora, New South Wales.

Geobasileus reguloides nesa Mathews, Bull. Brit. Ornith. Club, xl, 1920, p. 106; Bunya Mountains, Queensland.

Range.—South-eastern Queensland to south of Sydney, New South Wales.

Specimens Examined.—Twenty-six from the following localities: *Queensland*: Burnett River, Brisbane. *New South Wales*: Cobbora, Scone, Hawkesbury River, Turrumurra, vicinity of Sydney, Tarana (type of *tarana*).

Measurements.—Twenty-five adult specimens of both sexes: wing, 49-55 (52.7); tail, 36-43 (39.1); exposed culmen, 8.5-9 (8.8); tarsus, 16-17 (16.5).

Male.—General colour of upper parts deep greyish olive to greyish olive on rump; forehead anteriorly pinkish buff, followed by feathers similar in colour to upper surface, each with a curved subterminal band of light buff; lores, feathers surrounding eyes and ear-coverts white, tinged buff, and margined greyish olive; wings fuscous, quills with pale outer margins, and lesser upper wing-coverts deep greyish olive like back; upper tail-coverts chamois; basal half of tail light pinkish cinnamon with white shafts and margined chamois; tail distally blackish brown, broadly tipped avellaneous, indistinct on central feathers, increasing outwards, and continuing down the outer web of outermost feathers; chin, throat, and breast white, tinged straw yellow and most of the feathers narrowly tipped brownish, merging into straw yellow of remainder of under surface and under tail-coverts; axillaries white, tinged straw yellow; under wing-coverts and inner margin of wing-quills pale pinkish buff. "Eyes pale yellow; bill and feet dark brown."

Female.—Similar to male.

The type of *tarana* and specimens from Cobbora do not differ from typical *reguloides*, and this appears to be admitted by Mathews, who has consigned both *tarana* and *cobbora* to synonymy (Syst. Av. Aust., p. 609).

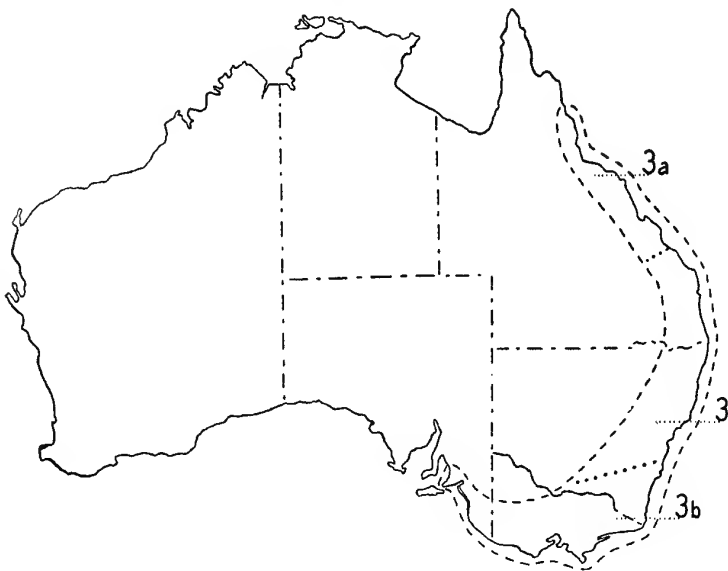


FIG. 3. DISTRIBUTION.

3, *Acanthiza reguloides reguloides*; 3a, *A. r. squamata*; 3b, *A. r. australis*.

Acanthiza reguloides squamata De Vis.

Acanthiza squamata De Vis, Proc. Roy. Soc. Queensld., vi, 1889, p. 248; Herberton, Queensland.

Range.—From vicinity of Cairns, north-eastern Queensland, south to the Dawson River.

Specimens Examined.—Two from Herberton, and Rio Station, Dawson River.

Measurements.—Male and female respectively: wing, 53, 50; tail, 39, 40; exposed culmen, 9, 9; tarsus, 17, 16.

Subspecific Characters.—Much lighter in colouration than *A. r. reguloides* and *A. r. australis*. Upper surface from greyish olive on crown to citrine-drab on rump; upper tail-coverts straw yellow; under surface barium yellow.

The scarcity of material from east coastal Queensland is again apparent in the number of specimens available of this race, but there is no question as to its validity. The Dawson River specimen is slightly darker than the one from Herberton, the type locality, and as two specimens of *A. r. reguloides* from Gayndah to some extent approach this race it would appear that intergradation with *reguloides* takes place in the area south-east of the Dawson River and north of Gayndah.

Although the relationship of this form and *A. r. reguloides* is obvious, it was erroneously included as a race of *chrysorhoa* by Mathews (Birds of Aust., ix, 1922, p. 465).

Acanthiza reguloides australis (North).

Geobasileus australis North, Aust. Mus. Spec. Cat., i, 1904, p. 287; Woodside, South Australia.

Acanthiza reguloides connectens Mathews, Nov. Zool., xviii, 1912, p. 352; Ringwood, Victoria.

Acanthiza reguloides grampianensis Ashby, Emu, xxvi, 1927, p. 290; Hall's Gap, Grampian Range, Victoria.

Range.—From south-eastern New South Wales, south and west to the vicinity of Adelaide, South Australia.

Specimens Examined.—Nineteen from the following localities: *Victoria*: Fernshaw, Healesville, Whittlesea, Lower Plenty River, Springvale, Croydon, Kilsyth, Bayswater, Muddy Creek, Parwan, Raywood, Nhill, Winiam. *South Australia*: Mt. Lofty, Upper Sturt, Callington, fifty miles south of Pinaroo.

Measurements.—Nineteen adult specimens of both sexes: wing, 50-56 (52.7); tail, 37-44 (39.2); exposed culmen, 9-10 (9.1); tarsus 16-17.5 (16.6).

Subspecific Characters.—Differs from both *A. r. reguloides* and *A. r. squamata* in its darker colouration throughout. Dorsal surface dark olive rather than deep greyish olive of typical *reguloides*; upper tail-coverts honey yellow; tail basally pinkish cinnamon, feathers margined honey yellow; lower ventral surface Naples yellow.

Victorian material examined is representative and is plainly to be referred here. The dark, more buffy, under surface as distinct from yellow in *reguloides* and *squamata* is a feature of this form.

ACANTHIZA INORNATA Gould.

It has been remarked that this species is closely related to *A. nana*, but a careful examination reveals that *inornata* is more closely allied to *iredalei* and *reguloides*, although all three are specifically distinct.

From the series examined two forms appear worthy of recognition.

Acanthiza inornata inornata Gould.

Acanthiza inornata Gould, Proc. Zool. Soc., 1840, p. 171; Swan River, Western Australia.

Acanthiza inornata carnarvoni Mathews, Aust. Av. Rec., ii, 1913, p. 76; Carnarvon, Western Australia.

Acanthiza inornata strellyi Mathews, *ib.*; Strelly River, Western Australia.

Range.—Coastal Western Australia from the De Grey River south, except extreme south-west.

Specimens Examined.—Eleven from the following localities: Solomon's Wells, Lake Yanchep, Perth, Guildford, Kelmscott, Brookton.

Measurements.—Eleven adult specimens of both sexes: wing, 47-52 (49.1); tail, 34-39 (36.4); exposed culmen, 8.9.5 (8.8); tarsus, 16-18 (16.8).

Male.—General colour of upper surface deep olive, tinged greyish, to citrine-drab on rump and upper tail-coverts; feathers of forehead with a curved subterminal band of cinnamon buff and tipped blackish brown; lores, feathers above and below eyes, and ear-coverts deep olive-buff, with narrow blackish brown margins; wings fuscous, lighter on outer margins of quills and upper coverts, from whitish on primaries to deep olive on inner secondaries and coverts; tail drab, tinged buffy brown at base, lighter at tip of inner webs, and crossed by a broad subterminal band of black which is indistinct on two central features; median portion of under surface deep olive-buff merging into dark olive-buff on sides of breast and flanks; feathers of chin, throat, and upper breast indistinctly tipped blackish brown; under tail-coverts white, tinged olive-buff; axillaries, under wing-coverts and inner margin of wing-quills pale pinkish buff. "Eyes pale buff; bill dark horn; feet blackish."

Female.—Similar to male.

As no specimens are available from coastal mid-western Australia, despite many collecting efforts, it would seem that the species is a rarity in that area which is the northern limit of its range. From the meagre descriptions of *carnavoni* and *strellyi* they appear to be based on examples of typical *inornata* in unworn and worn plumage respectively. Mathews (Syst. Avium Aust., p. 605) has since consigned both names to the synonymy of *submastersi*, which, however, in my opinion, is a synonym of *mastersi*.

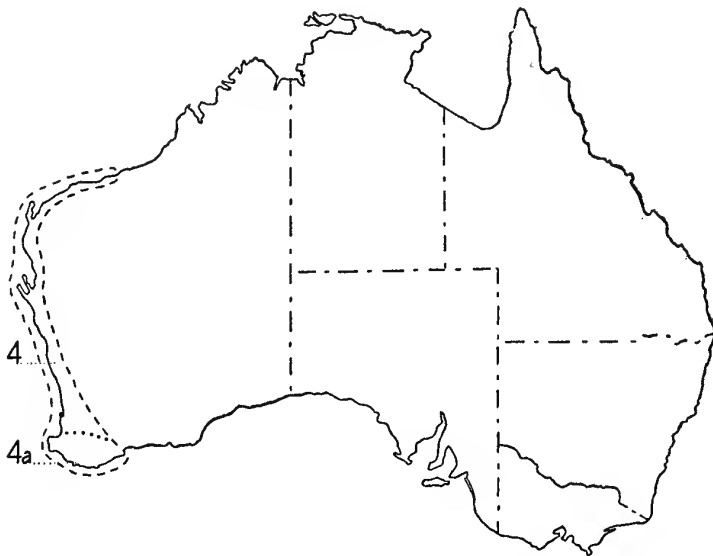


FIG. 4. DISTRIBUTION.

4, *Acanthiza inornata inornata*; 4a, *A. i. mastersi*.

Acanthiza inornata mastersi North.

Acanthiza mastersi North, Agr. Gaz. New South Wales, xii, 1901, p. 1,425; Albany, Western Australia.

Acanthiza inornata submastersi Mathews, Aust. Av. Rec., i, 1912, p. 45; Stirling Ranges, Western Australia.

Range.—Extreme south-west Western Australia.

Specimens Examined.—Seventeen from the following localities: Warren River, Lake Muir, Irwin's Inlet, Wilson's Inlet, Torbay, Albany, Stirling Ranges.

Measurements.—Sixteen adult specimens of both sexes: wing, 47-51 (48·5); tail, 35-38 (36·3); exposed culmen, 8·5-9·5 (9); tarsus, 16-17·5 (16·8).

Subspecific Characters.—Much darker, more brownish, in colouration both above and below than typical *inornata*. Upper surface brownish olive; median portion of under surface warm buff merging into dark olive-buff tinged citrine-drab on sides of breast, flanks, and under tail-coverts; dark margins to feathers of chin and throat more prominent.

This race is no exception to the rule that almost all forms described before the literature of Australian ornithology became cluttered with hundreds of unnecessary trinomials are valid and easily recognized.

It is plain that the birds from the Stirling Ranges are to be referred here, although occasional specimens are slightly paler than typical *mastersi*.

ACANTHIZA IREDALEI Mathews.

There has been confusion as to the relationship of the three races admitted here, and unwarranted doubt has been expressed regarding the correct specific name. Briefly it may be stated that as *Acanthiza tenuirostris* Zietz is preoccupied, it is clear that *iredalei*, which has line priority over *morgani*, becomes the name for the species, and there is no apparent reason for according other than subspecific rank to both *hedleyi* and *rosinae*.

The peculiarly-restricted range of this species in South Australia and Victoria is unusual, but it should be noted that it overlaps the range, respectively, of the closely related *reguloides* and *inornata* only in the extreme east and west.

Acanthiza iredalei iredalei Mathews.

Acanthiza tenuirostris Zietz, Trans. Roy. Soc. S. Aust., xxiv, 1900, p. 112; Leigh's Creek, South Australia. (Not *Acanthiza tenuirostris* Lafresnaye, Rev. Zool., 1841, p. 242.)

Acanthiza iredalei Mathews, Bull. Brit. Ornith. Club, xxvii, 1911, p. 97; Lake Way, Western Australia.

Acanthiza morganii Mathews, *ib.*; new name for *Acanthiza tenuirostris* Zietz.

Geobasileus tenuirostris uranie A. G. Campbell, *Emu*, xxv, 1925, p. 62; Shark Bay, Western Australia.

Range.—From coastal mid-western Australia, south-east to the vicinity of Leigh's Creek, Port Augusta, and the north of Eyre Peninsula, South Australia.

Specimens Examined.—Twenty-eight from the following localities: *Western Australia*: Carnarvon, Shark Bay (type of *G. t. uranie*), Day Dawn, Lake Way, Naretha. *South Australia*: Stuart's Range, Leigh's Creek (type of *tenuirostris* Zietz), Coralbignie, Wertigo, Eyre Peninsula.

Measurements.—Twenty-three adult specimens of both sexes: wing, 47-51 (43.1); tail, 38-42 (40.1); exposed culmen, 7-8 (7.6); tarsus, 16-18 (16.8).

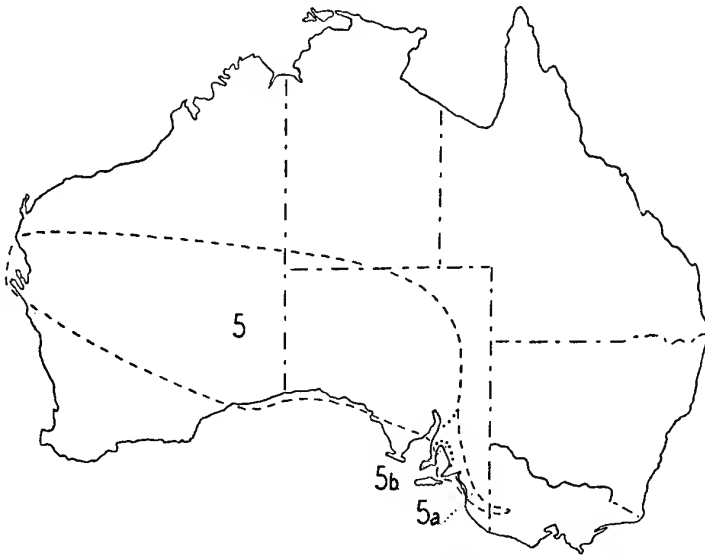


FIG. 5. DISTRIBUTION.

5, *Acanthiza iredalei iredalei*; 5a, *A. i. hedleyi*; 5b, *A. i. rosinae*.

Male.—Dorsal surface greyish olive, lighter on lower back and feathers of forehead distally blackish brown with a curved subterminal band of white; lores, feathers above and below eyes, and ear-coverts pale olive-buff, with narrow blackish brown margins; wings hair brown, much lighter on outer margins of quills and upper coverts; upper tail-coverts cartridge buff to cream buff; tail basally hair brown, merging into blackish brown, each feather broadly tipped and margined on outer web drab, with a white spot at tip of inner margin of all but central feathers; extent of drab and white increasing outwardly to whitish on outer web of outermost feathers; chin, throat and upper breast whitish, tinged pale olive-buff, the feathers distally finely margined blackish brown; remainder of ventral surface olive-buff, to cream buff on flanks; under tail-coverts cartridge buff; axillaries and under wing-coverts cream buff; inner margins of wing quills whitish. "Eyes pale buff; bill and feet black."

Female.—Similar to male.

Topotypical specimens in no way differ from the type of *Acanthiza tenuirostris* Zietz, which I have examined, and other material from South Australian localities. The birds from Shark Bay described by Campbell under *Geobasileus tenuirostris uranie* comprise three adult females and two immature examples. The adults are in worn plumage, which explains the lack of olive colour on the dorsal surface noted by Campbell.

In length of bill and tarsus this form averages less than *hedleyi* and *rosinae*.

Acanthiza iredalei hedleyi Mathews.

Acanthiza iredalei hedleyi Mathews, Aust. Av. Rec., i, 1912, p. 78; Meningie, South Australia.

Acanthiza winiamida Wilson, Emu, xvi, 1917, p. 169; Winiam, Victoria.

Range.—From the Little Desert, mid-western Victoria, west and north-west to south of Port Augusta, South Australia.

Specimens Examined.—Eleven from the following localities: *Victoria*: Winiam (type of *winiamida*). *South Australia*: Coombe, Salt Creek, near Meningie, Port Broughton.

Measurements.—Eleven adult specimens of both sexes: wing, 49-53 (50·1); tail, 38-43 (40·4); exposed culmen, 7·5-8 (8·1); tarsus, 17-18 (17·3).

Subspecific Characters.—Intermediate in colouration between typical *iredalei* and *rosinae*, being darker than the former and lighter than the latter. Dorsal surface deep to dark greyish olive; chin and throat greyish, tinged olive-buff, with blackish brown margins of feathers more marked than in *iredalei*; remainder of under surface olive-buff to deep olive-buff, suffused citrine-drab to deep olive on sides of breast and flanks; axillaries and under coverts deep olive-buff.

This race closely resembles *iredalei* and to accord it other than subspecific status is clearly unwarranted. Winiam material described under *A. winiamida* does not differ from typical *hedleyi*.

Acanthiza iredalei rosinae Mathews.

Acanthiza rosinae Mathews, Aust. Av. Rec., ii, 1913, p. 9; near Adelaide, South Australia.

Range.—Samphire flats bordering the east and north-west shores of St. Vincent's Gulf, South Australia.

Specimens Examined.—Twelve from St. Kilda, near Adelaide, South Australia.

Measurements.—Twelve adult specimens of both sexes: wing, 48-50 (49); tail, 39-43 (40·6); exposed culmen, 8·8-5 (8·1); tarsus, 17·5-19 (18).

Subspecific Characters.—Much darker in colouration than both other forms. Dorsal surface dark olive; white subterminal band of forehead feathers tinged brownish; wings fuscous; upper tail-coverts dark olive-buff; tail blackish brown to black, and lighter tips much restricted; chin and throat greyish with distinct blackish brown margins as in *hedleyi*; remainder of ventral surface buffy olive to olive, lighter on median portion; axillaries and under wing-coverts buffy olive; inner margins of quills greyish.

As evidence of the confusion associated with the genus, originally this form was compared with the type of *Acanthiza reguloides australis* (North) and accorded specific rank. Subsequently Mathews listed it as a race of *Geobasileus hedleyi*, which in the first place was described as a race of *Acanthiza iredalei*.

While similar in size to *hedleyi*, this is the darkest race of the species. Its restricted range is probably unique in Australia.

ACANTHIZA UROPYGIALIS Gould.

This species is distributed throughout the interior where the annual rainfall does not exceed 15 inches. Two forms can be distinguished and the ranges of these correspond with the difference in habitat between the area immediately west of the coastal highlands and the arid inland.

Acanthiza uropygialis uropygialis Gould.

Acanthiza uropygialis Gould, Synop. Birds of Aust., 1838, pl. 60; New South Wales.

Acanthiza uropygialis ruthergleni Mathews, Nov. Zool., xviii, 1912 p. 350; Rutherglen, Victoria.

Range.—South-central Queensland, south through inland New South Wales to northern Victoria and adjoining part of South Australia.

Specimens Examined.—Twenty-eight from the following localities: *New South Wales*: Mogil Mogil, Cobbora, Grenfell, Byrock, Bourke, Moolah, Coonamble, Yandembah. *Victoria*: Junction Murray and Darling Rivers, Rutherglen, Linga, Kow Plains, Ouyen, Grampians, Nhill. *South Australia*: Renmark, Murray River, Swan Reach.

Measurements.—Twenty-five adult specimens of both sexes: wing, 50-54 (51·6); tail, 36-41 (38·9); exposed culmen, 8-9 (8·3); tarsus, 16-17·5 (16·6).

Male.—Dorsal surface olive brown tinged drab, except crown which is suffused russet; forehead blackish brown, each feather with curved sub-terminal band of white; lores, above and below eyes, and ear-coverts dull white, each feather narrowly margined brown; wings fuscous, margins of upper coverts and quills lighter, to whitish on primaries; upper tail-coverts and basal half of tail tawny; distal portion of tail black, tipped drab except for white spot at tip of inner margin of all but central feathers; chin, throat,

and breast dull or greyish white, suffused light drab on sides of breast, and each feather indistinctly tipped blackish brown; remainder of ventral surface and under tail-coverts white, the flanks tinged cinnamon buff; axillaries, under wing-coverts and inner margins of wing-quills white, tinged pale pinkish buff. "Eyes buff; bill dark horn; feet black."

Female.—Similar to male.

Specimens from Rutherglen and elsewhere in Victoria and South Australia do not differ from typical examples.

Although there is little doubt that this form ranges throughout south-central Queensland, the necessary Queensland material, as in other instances, is again a desiderata.

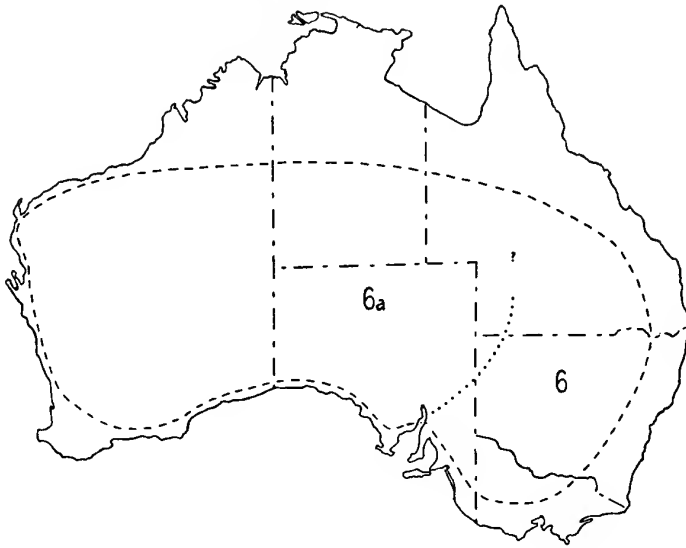


FIG. 6. DISTRIBUTION.

6, *Acanthiza uropygialis uropygialis*; 6a, *A. u. mellori*.

Acanthiza uropygialis mellori Mathews.

Acanthiza uropygialis mellori Mathews, Nov. Zool., xviii, 1912, p. 350; Eyre Peninsula, South Australia.

Acanthiza uropygialis augusta Mathews, *ib.*; Port Augusta, South Australia.

Acanthiza uropygialis nea Mathews, *ib.*; Burracoppin, Western Australia.

Acanthiza uropygialis murchisoni Mathews, *ib.*; East Murchison, Western Australia.

Acanthiza uropygialis condora Mathews, Aust. Av. Rec., i, 1912, p. 78; Leigh's Creek, South Australia.

Geobasileus uropygialis moora A. G. Campbell, Emu, xxii, 1922, p. 65; Moora, Western Australia.

Geobasileus uropygialis erema A. G. Campbell, *ib.*; Kychering Soak, South Australia.

Acanthiza uropygialis kycheringi Mathews, Bull. Brit. Ornith. Club, xliii, 1922, p. 14; new name for preceding.

Range.—South-western Queensland and extreme western New South Wales, west to inland mid-western Australia; north at least to Macdonnell Ranges and south to Eyre Peninsula.

Specimens Examined.—Fifty-one from the following localities: *South Australia*: Nonning, Mt. Gunson, Gawler Ranges, Lake Gairdner, Kychering (type of *G. u. erema*), Ooldea, Musgrave Ranges, Ernabella, Everard Ranges, Oodnadatta. *Central Australia*: Macdonnell Ranges: Hermannsburgh, James Ranges. *Western Australia*: Naretha, Zanthus, Doodlakine, Kellerberrin, Jonesville, Yalgoo, Day Dawn, Lake Way.

Measurements.—Fifty-one adult specimens of both sexes: wing, 48-54 (50.9); tail, 35-43 (39.1); exposed culmen, 8.8-5 (8.3); tarsus, 16-18 (16.05).

Subspecific Characters.—Differs from typical *uropygialis* in its paler colouration throughout. Dorsal surface drab to hair brown, russet on crown almost lacking; under surface more distinctly white, the light drab on sides of breast and cinnamon buff on flanks much reduced.

The name *mellori* is used for this form because of line priority. The original diagnosis, which is either incorrect or based on an abnormally coloured specimen, is as follows:

"Differs from *A. w. ruthergleni* in its greyer upper colouration, only the head and upper back being greenish. South Australia (Eyre's Peninsula)."

This quotation is repeated by Mathews in his *Birds of Australia* and in addition, a specimen, stated to be the type of *mellori*, is described in full with the "head, back, and wings mouse brown," and the type locality given as "Murray Flats, S. Australia." It will be admitted that mouse brown is closer to the drab colour of the dorsal surface than grey and greenish, but the Murray Flats, which is within the range of typical *uropygialis* as defined here, is considerably to the east of Eyre Peninsula and is separated from that area by both sea and land.

The other subspecies named, in my opinion, are not separable. The specimens from which *G. u. erema* was described are immature.

ACANTHIZA ROBUSTIROSTRIS Milligan.

Acanthiza robustirostris Milligan, Emu, iii, 1903, p. 71; Day Dawn, Western Australia.

Acanthiza marionae S. A. White, South Aust. Ornith., ii, 1915, p. 45; Everard Ranges, Central Australia.

Milligania robustirostris liberia Mathews, Aust. Av. Rec., iii, 1916, p. 61; Siberia Soak, Western Australia.

Milligania robustirostris moorilyanna Mathews, Bull. Brit. Ornith. Club, xxxvi, 1916, p. 90; Everard Ranges, Central Australia.

Range.—Inland mid-western to Central Australia.

Specimens Examined.—Nineteen from the following localities: *Western Australia*: Day Dawn, Yalgoo, Lake Way, Borewell. *Central Australia*: Musgrave Ranges, Everard Ranges, Moorilyanna, Snider's Hill, Cockatoo Creek, Hermannsburg.

Measurements.—Seventeen adult specimens of both sexes: wing, 50-54 (52); tail, 39-45 (41·9); exposed culmen, 8-8·5 (8·2); tarsus, 17·5-19 (18).

Male.—Forehead blackish, each feather with a curved subterminal band of white; from forehead to nape neutral grey, shafts of feathers prominently brownish black; lores, above and below eyes whitish, each feather margined dark brown; upper and lower back mouse grey; feathers of rump broadly tipped white, tinged buff; upper tail-coverts wood brown; basal portion of tail avellaneous, becoming blackish brown and pale drab at tip, with a white spot at tip of inner margins of all except central feathers; wings fuscous, outer margins of basal half of primaries and greater wing-coverts, and both margins of secondaries dull white; upper and median wing-coverts broadly margined mouse grey; general colour of ventral surface including under tail-coverts, white, dull on chin and throat, tinged grey and buff on breast, and vinaceous buff on flanks; axillaries, under wing coverts and inner margins of wing-quills white, tinged buff. "Eyes reddish brown; bill and feet black."

Female.—Similar to male.

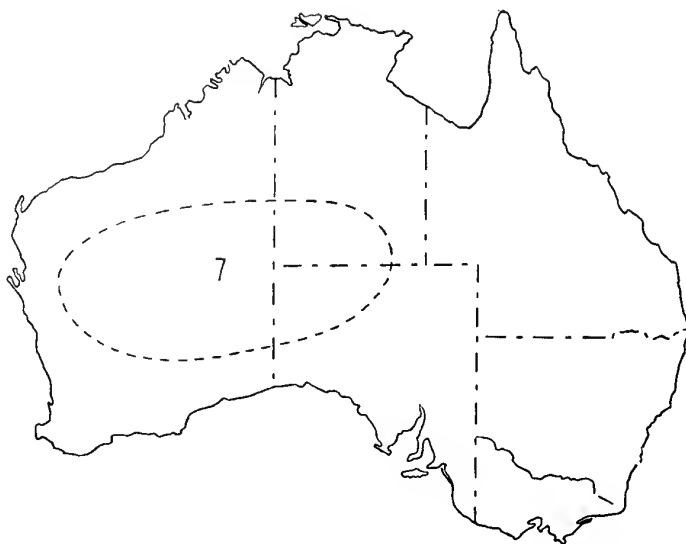


FIG. 7. DISTRIBUTION.

7, *Acanthiza robustirostris*.

Although resembling *uropygialis* in the rufescent colour of base of tail and upper tail-coverts, this is a well-marked and distinct species, and both species are found in the same area. The grey colour of the dorsal surface, and blackish shaft lines of the crown are characters peculiar to *robustirostris*. I have

failed to find anything unusual in the shape and size of the bill, notwithstanding it was referred to in naming the species, and has been used even as a generic character. In structure and measurements *robustirostris* is very similar to other species of the genus.

No difference is apparent between specimens from the type locality and those from Everard Ranges and elsewhere in Central Australia. The rainfall and general conditions being similar at and between these two points, racial differences are not to be expected. The author of *M. r. liberia* has consigned that name to synonymy (Mathews, Birds of Aust., ix, 1922, p. 462).

ACANTHIZA NANA Vigors and Horsfield.

Six types and one paratype of the nine forms named have been available to me and it is clear that only four subspecies are warranted. In this species it is the inland pallid form, *A. n. modesta* (type of *dawsoniana*), that is represented in a collection from the lower Dawson River, Queensland.

Acanthiza nana nana Vigors and Horsfield.

Acanthiza nana Vig. and Horsf., Trans. Linn Soc., xv, 1827, p. 226; Sydney, New South Wales.

Acanthiza nana dorotheae Mathews, Emu, xiv, 1914, p. 60; Lithgow, New South Wales.

Acanthiza nana clelandi Mathews, *ib.*, p. 121; new name for preceding.

Acanthiza nana belltrees A. G. Campbell, Emu, xxii, 1922, p. 64; Scone, New South Wales.

Range.—South-eastern Queensland to south of Sydney, New South Wales.

Specimens Examined.—Twenty-three from the following localities: *Queensland*: Gowrie. *New South Wales*: Scone (type of *belltrees*), Blacktown, Woolahra, Narrabeen, various localities vicinity of Sydney, Liverpool, Lithgow (type of *dorotheae*).

Measurements.—Twenty-two adult specimens of both sexes: wing, 47-52 (49); tail, 34-39 (35.6); exposed culmen, 7-8.5 (7.9); tarsus, 15-17 (16.5).

Male.—Dorsal surface olive citrine to yellowish citrine on rump and upper tail-coverts, with crown tinged buffy and forehead straw yellow; indistinct superciliary stripe citron yellow; feathers of lores and cheeks straw yellow with dusky tips, and those of the ear-coverts dark brown with shafts straw yellow; wings fuscous, margins of coverts and outer margins of inner secondaries olive-citrine to dull citrine, outer margins of remainder of wing-quills citron yellow; tail hair brown with outer webs basally and outer margins distally yellowish citrine, the whole crossed by a broad subterminal band of black which is reduced to large spots on the two central feathers;

chin and upper throat chamois to cream-buff, merging into citron yellow of remainder of ventral surface and under tail-coverts, with flanks strontian yellow and sides of breast tinged olive-citrine; axillaries and under wing-coverts white, tipped pale yellow; inner margins of wing-quills white. "Eyes yellowish white; bill dark brown; feet brownish black."

Female.—Similar to male.

The type of *belltrees* and other specimens from Scone are in unworn plumage, and therefore slightly brighter in colouration than those from south Queensland to the north, and Sydney, (the type locality) in the south. Mathews has consigned *burtoni* to synonymy, and the type of *dorotheae* is typical *nana*.

Acanthiza nana flava H. L. White.

Acanthiza nana flava H. L. White, Emu, xxii, 1922, p. 97; Herberton, Queensland.

Range.—From about Cairns to south of Cardwell, north-eastern Queensland.

Specimens Examined.—Type and paratype from Ravenshoe.

Measurements.—One male, one female respectively: wing, 52, 48; tail, 41, 38; exposed culmen, 8, 8; tarsus, 15, 15.

Subspecific Characters.—Differs from all other races of *nana* in its richer, much brighter colouration; nearest to typical *nana* and markedly different from *modesta* and *mathewsi*. Dorsal surface dark citrine to citrine; chin and throat antimony yellow merging into strontian yellow of remainder of ventral surface; axillaries citron yellow with dusky bases.

In describing this form from two specimens, probably the only two in an Australian collection, doubtless H. L. White was influenced by the known distinction in the fauna of the range given. The difference in colouration is striking and *A. n. flava* appears well worthy of recognition.

Acanthiza nana mathewsi Hartert.

Acanthiza nana mathewsi Hartert, Bull. Brit. Ornith. Club, xxv, 1910, p. 82; Springvale, Victoria.

Range.—From south of Sydney, New South Wales, south and west to north of Adelaide, South Australia.

Specimens Examined.—Twelve from the following localities: *Victoria*: Rosedale, Springvale (paratype of *mathewsi*), Raywood, You Yangs. *South Australia*: Grange, Sandy Creek, Laura.

Measurements.—Eleven specimens of both sexes: wing, 48-52 (49.7); tail, 38-42 (38.6); exposed culmen, 8.8.5 (8.1); tarsus 16-17 (16.7).

Subspecific Characters.—Resembling *A. n. modesta*, but darker and much duller in colouration than any other race. Upper surface saccardo's olive; chin and throat pinkish buff to cinnamon buff, extending on to breast and becoming dull citrine on lower under surface.

The dull olive colour of the back and greenish under surface, compared with the rich green and yellow of these parts in typical *nana* and *flava*, makes this an easily recognized race. Specimens from the extreme north-western part of the range are intermediate between *modesta* and *mathewsi*.

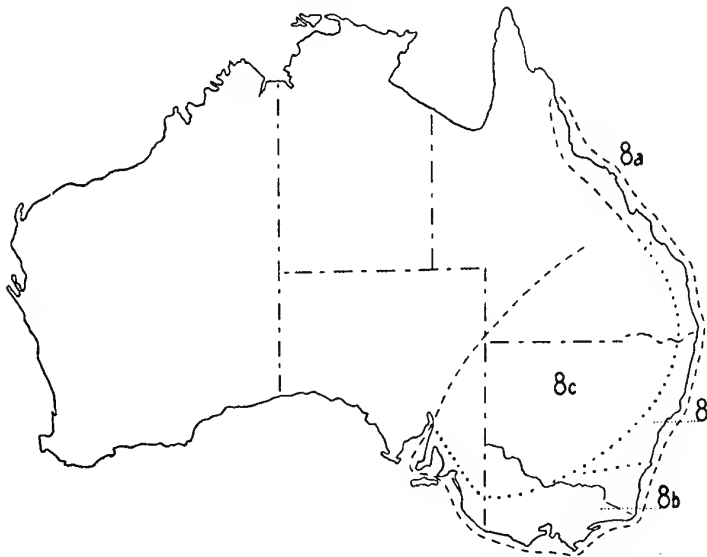


FIG. 8. DISTRIBUTION.

8, *Acanthiza nana nana*; 8a, *A. n. flava*; 8b, *A. n. mathewsi*; 8c, *A. n. modesta*.

Acanthiza nana modesta De Vis.

Acanthiza modesta De Vis, Ann. Queensld. Mus., No. 6, 1905, p. 43; Charleville, Queensland.

Acanthiza pygmaea Milligan, Emu, xii, 1913, p. 167; Mallee, Victoria.

Acanthiza nana dawsoniana H. L. White, Emu, xviii, 1918, p. 122; Dawson River, Queensland.

Range.—From inland mid-eastern Queensland, south-west through inland New South Wales to north-western Victoria and adjoining part of South Australia.

Specimens Examined.—Twenty-three from the following localities: *Queensland*: Dawson River (type of *dawsoniana*), Charleville (type of *modesta*). *New South Wales*: Manilla district, Cobbora. *Victoria*: Kow Plains (type of *pygmaea*), Raak. *South Australia*: Murray River, Flinders Range.

Measurements.—Twenty-two adult specimens of both sexes: wing, 48-54 (49·8); tail, 37-42 (38·8); exposed culmen, 8-9 (8·2); tarsus, 16-17 (16).

Subspecific Characters.—Differs markedly from all other forms, particularly typical *nana* and *flava*, in its much paler colouration throughout. Dorsal surface dull citrine, chin and throat Naples yellow, merging on breast to naphthalene yellow of remainder of ventral surface, tinged barium yellow on flanks.

The pallid colouration of this form is in striking contrast to the rich green and yellow of typical *nana*. Milligan described *pygmea* as being smaller in all dimensions compared with *mathewsi*, but this is not borne out by the type and topotypical material; indeed, all four forms are markedly similar in size. Greater length of bill was the reason for H. L. White naming *dawsoniana*, but one-half to one millimetre in length of culmen does not warrant separation. Specimens from widely separated localities exhibit this slight difference.

In his *Birds of Australia* (ix, 1922, p. 449) Mathews erroneously included *A. n. modesta* as a race of *A. lineata*, giving the range as "North Queensland."

ACANTHIZA LINEATA Gould.

Inhabiting chiefly mountainous and heavily-afforested country, the range of *lineata* is more restricted than that of any other species of the genus in eastern Australia. Two races can be distinguished, specimens from the south being distinctly darker than typical examples.

Acanthiza lineata lineata Gould.

Acanthiza lineata Gould, Synop. Birds of Aust., pt. iv, 1838, pl. 59; New South Wales.

Acanthiza lineata goulburni Mathews, Aust. Av. Rec., i, 1912, p. 93; New South Wales.

Acanthiza lineata whitei Mathews, Bull. Brit. Ornith. Club., xl, 1920, p. 106; Bunya Mountains, Queensland. (Not *A. lineata whitei* Mathews, Aust. Av. Rec., i, 1912, p. 44.)

Acanthiza lineata alberti Mathews, *ib.*, p. 121, new name for preceding.

Range.—South-eastern Queensland to south of Sydney, New South Wales.

Specimens Examined.—Twenty-eight from the following localities: *Queensland*: Ithaca Creek, Brisbane. *New South Wales*: Scone, Seaham, Enfield, vicinity of Sydney, Penrith, Mulgoa, Tarana, Lithgow.

Measurements.—Twenty-eight adult specimens of both sexes: wing, 50-56 (52.3); tail, 35-41 (38.5); exposed culmen, 8-9 (8.1); tarsus, 15-17 (16.4).

Male.—Forehead to nape olive-brown, the shaft of each feather white, merging into deep olive of back and becoming citrine-drab on rump and upper tail-coverts; feathers of lores, superciliary stripe, and ear-coverts white, each feather finely margined brown; wings fuscous, outer margins of coverts and quills deep olive to whitish on primaries; tail hair brown, basal half of each feather tinged citrine-drab on outer web and some with lighter margin on inner web at tip, the whole crossed by a broad subterminal band of black which is reduced to large spots on central feathers; chin, throat and breast white, tinged yellow and finely margined on both webs with dark brown, giving a striated appearance; sides of breast tinged deep olive; abdomen and flanks

deep colonial buff; under wing-coverts cartridge buff, inner margin of wing-quills white. "Eyes brownish; bill and feet dark brown."

Female.—Similar to male.

While specimens from south-eastern Queensland and the north-eastern part of New South Wales are similar, those from localities to the east and south-east of Sydney approach *chandleri* in colouration.

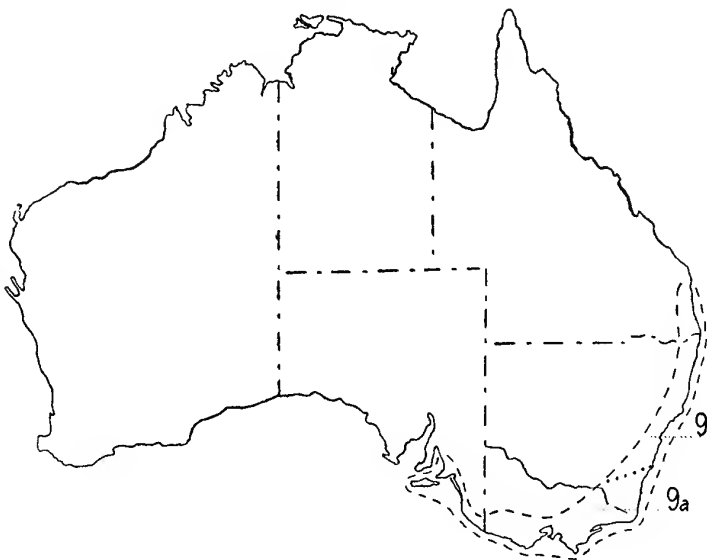


FIG. 9. DISTRIBUTION.

9, *Acanthiza lineata lineata*; 9a, *A. l. chandleri*.

Acanthiza lineata chandleri Mathews.

Acanthiza lineata chandleri Mathews, Nov. Zool., xviii, 1912, p. 349; Olinda, Victoria.

Acanthiza lineata clelandi Mathews, *ib.*; Mount Lofty, South Australia.

Acanthiza lineata whitei Mathews, Aust. Av. Rec., i, 1912, p. 44; Kangaroo Island, South Australia.

Range.—From south of Sydney, New South Wales, south and west to Mt. Lofty and Kangaroo Island, South Australia.

Specimens Examined.—Twenty-four from the following localities: *Victoria*: Big River, Healesville, Beaconsfield, Olinda, Kilsyth, Ringwood, Frankston, Grampians, Lorne. *South Australia*: Beachport, Mt. Lofty, various localities Kangaroo Island.

Measurements.—Twenty-three adult specimens of both sexes: wing, 50-57 (52.5); tail, 35-41 (38.7); exposed culmen, 8-9 (8.3); tarsus, 16-17 (16.4).

Subspecific Characters.—Darker, more brownish above than the typical form, and the lower ventral surface green rather than yellow. Top of head

bister brown; back and upper tail-coverts tinged brownish olive; lower breast tinged and flanks and abdomen entirely ecru-olive; under tail-coverts chamois.

This race was described as differing from *lineata* in being "much darker above and browner below." In specimens examined only the narrow margins of the throat and breast feathers are brown, the lower ventral surface is greenish as distinct from yellow in typical *lineata*. Birds from Kangaroo Island and South Australia are essentially similar to those from Victorian localities.

ACANTHIZA CHRYSORRHOA (Quoy and Gairmard).

This species is almost as widely distributed as *A. pusilla*, but apparently it is uncommon except in coastal areas. It has not been collected from any of the islands of Bass Strait or from Kangaroo Island, South Australia, although a fairly common form in Tasmania.

A feature of the species is the extension of the range of some races beyond the limits of normal faunal areas.

Acanthiza chrysorrhoa chrysorrhoa (Quoy and Gairmard).

Saxicola chrysorrhoa Quoy and Gairmard, Voy. Astrol., i, 1830, p. 198; New South Wales.

Acanthiza leighi Grant, Bull. Brit. Ornith. Club., xxiii, 1909, p. 73; Lithgow, New South Wales.

Range.—From south-eastern Queensland to south of Sydney, New South Wales; west to Cobbora.

Specimens Examined.—Thirty-four from the following localities: *New South Wales*: Warialda, Scone, Cobbora, Lithgow, Tarana, Helensburgh, Roseville, Lilyvale, Sutherland, Liverpool, Bowral, Goulburn.

Measurements.—Thirty-one adult specimens of both sexes: wing, 58-62 (59·9); tail, 36-42 (39·8); exposed culmen, 9-11 (9·7); tarsus, 16-17 (16·7).

Male.—Narrow band across forehead, lores, and superciliary stripe white, most feathers very finely tipped black, appearing as a black spot immediately in front of eyes; ear-coverts dull white with narrow brownish margins; fore part of crown black, each feather broadly tipped white with indistinct dusky margins; feathers of posterior part of crown blackish brown, broadly margined light greyish olive, merging on nape into citrine-drab of mantle and lower back; wings fuscous, outer margins of quills lighter, from whitish on primaries to citrine-drab on inner secondaries, and margins of upper coverts light greyish olive; upper tail-coverts strontian yellow, longer feathers distally tinged greenish; tail basally strontian yellow, each feather with white shaft; tail distally black, each feather broadly tipped drab except for white spot at tip of inner web of lateral feathers; chin and throat white, some feathers on sides of throat finely tipped brownish; remainder of ventral surface straw yellow, richer on flanks, tinged drab on sides of breast, and some feathers

of upper breast tipped brownish; under tail-coverts barium yellow; under wing-coverts light drab and white, with axillaries white tinged yellow; inner margin of wing-quills white. "Eyes brown; bill and feet black."

Female.—Similar to male.

The unusual western extension of the range of this form has been remarked under *reguloides*; typical specimens only have been obtained at Cobbora, west of the coastal highlands.

Acanthiza chrysorrhoa sandlandi Mathews.

Acanthiza chrysorrhoa sandlandi Mathews, Nov. Zool., xviii, 1912, p. 351; Blackburn, Victoria.

Acanthiza chrysorrhoa perksi Mathews, *ib.*; Mount Lofty, South Australia.

Range.—From south-eastern New South Wales through southern Victoria to north of Adelaide, South Australia.

Specimens Examined.—Seventeen from the following localities: *Victoria*: Lower Plenty River, Beaconsfield, Springvale, Cheltenham, Preston, Parwan, Melton, Myers Flat, You Yangs. *South Australia*: Burnside, Buckland Park, Glen Osmond, Laura.

Measurements.—Seventeen adult specimens of both sexes: wing, 58-62 (59); tail, 36-43 (39·2); exposed culmen, 9-10 (9·1); tarsus, 16-17 (16·5).

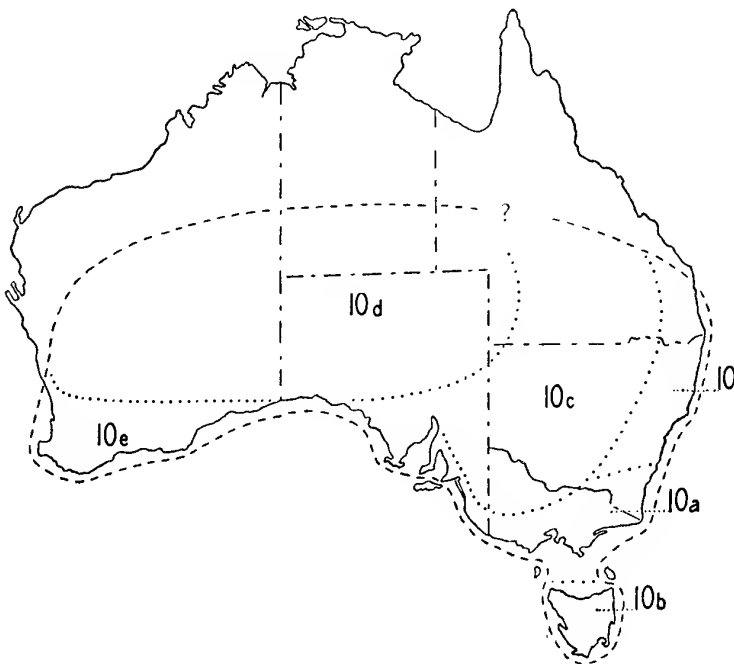


FIG. 10. DISTRIBUTION.

10, *Acanthiza chrysorrhoa chrysorrhoa*; 10a, *A. c. sandlandi*; 10b, *A. c. leachi*; 10c, *A. c. addenda*; 10d, *A. c. ferninandi*; 10e, *A. c. multi*.

Subspecific Characters.—Differs markedly from *A. c. chrysorrhoa* in its darker colouration, particularly the under surface, which is buff as distinct from yellow in the typical race. General colour above deep olive; chin and throat white, in some warm buff like remainder of median portion of under surface, merging into dark olive-buff on flanks and sides of breast; under tail-coverts white, tinged yellow; axillaries and under wing-coverts white tinged warm buff.

Easily distinguished by the deep buff colour of the under surface from all races of *chrysorrhoa* except *multi*, from which it differs in its more intense colouration and particularly in having the under tail-coverts washed with yellow, not pure white. Specimens from south-eastern South Australia are similar to typical *sandlandi*.

Acanthiza chrysorrhoa leachi Mathews.

Acanthiza chrysorrhoa leachi Mathews, Nov. Zool., xviii, 1912, p. 351; Tasmania.

Range.—Tasmania.

Specimens Examined.—Five from Launceston, Swansea and Hobart.

Measurements.—Five adults of both sexes: wing, 58-61 (59.6); tail, 38-44 (40.2); exposed culmen, 9-11 (10); tarsus, 16-17 (16.6).

Subspecific Characters.—Similar to *sandlandi*, differing only in the lighter colour of upper parts in which it equals typical *chrysorrhoa*.

The lighter colour of the upper surface is constant in the few specimens available, but this race is not markedly different from *sandlandi*. It appears worthy of recognition, however, in view of its insular habitat, and the fact that the species has not been collected in any of the Bass Strait islands.

Acanthiza chrysorrhoa addenda Mathews.

Acanthiza chrysorrhoa addenda Mathews, Aust. Av. Rec., i, 1912, p. 44; Port Augusta, South Australia.

Geobasileus chrysorrhoa normantoni Mathews, *ib.*, ii, 1913, p. 76; Normanton, Queensland.

Geobasileus chrysorrhoa mallee A. G. Campbell, Emu, xxii, 1922, p. 66; Mallee, Victoria.

Range.—Central Queensland, inland New South Wales, north-western Victoria and adjoining country of South Australia west at least to Eyre Peninsula.

Specimens Examined.—Fourteen from the following localities: *Queensland*: Charleville. *Victoria*: Kow Plains (type of *mallee*). *South Australia*: Moolawatana, Mt. Searle, Kallioota, Coffin's Bay Peninsula.

Measurements.—Fourteen adult specimens of both sexes: wing, 57-62 (59.2); tail, 38.43 (40.2); exposed culmen, 9-10 (9.8); tarsus, 16.5-17.5 (16.9).

Subspecific Characters.—Resembling *sandlandi* and *leachi* but altogether paler. Upper surface citrine-drab with nape light greyish olive; under surface white, tinged deep olive-buff.

Specimens from western New South Wales are lacking, but those from south Central Queensland, north-west Victoria, and the adjoining area of South Australia are clearly referable to one subspecies. As this bird is only an occasional visitor to north-central Queensland, it is probable that the specimens from which *normantoni* was described were forced north by dry conditions. Whether *normantoni* is to be referred here or to *ferdinandi* is not clear.

Acanthiza chrysorrhoa ferdinandi (Mathews).

Acanthiza pallida Milligan, Emu, iii, 1903, p. 111; Yalgoo, Western Australia. (Not *Acanthiza pallida* Finsch, Notes Leyden Mus., xx, 1898, p. 347).

Geobasileus chrysorrhoa ferdinandi Mathews, Bull. Brit. Ornith. Club, xxxvi, 1916, p. 90; Musgrave Ranges, Central Australia.

Geobasileus chrysorrhoa alexanderi Mathews, Aust. Av. Rec., iv, 1921, p. 137; new name for *Acanthiza pallida* Milligan.

Geobasileus chrysorrhoa pallescens A. G. Campbell, Emu, xxii, 1922, p. 65; Levi Ranges, Central Australia.

Geobasileus westernensis A. G. Campbell, Emu, xxii, 1922, p. 65; Moora, Western Australia.

Range.—Extreme western Queensland, and probably north-western New South Wales, west through Central Australia to inland mid-western Australia.

Specimens Examined.—Ten from the following localities: *Central Australia*: Macdonnell Ranges, Hermannsburg, James Ranges (type of *pallescens*). *Western Australia*: Ebano, Yandanooka, Wongan Hills.

Measurements.—Ten adult specimens of both sexes: wing, 56-62 (54.1); tail, 39-44 (41); exposed culmen, 10-11 (10.3); tarsus, 16.5-18 (17.4).

Subspecific Characters.—Much paler in colouration than any other race of *chrysorrhoa*. Similar to the typical form in its yellowish under surface and yellow under tail-coverts. Dorsal surface from light greyish olive on nape to yellowish citrine on lower back; under surface white, suffused straw yellow, except on chin and throat, and tinged cartridge buff on breast; under tail-coverts barium yellow.

Although the species is common in coastal areas it would seem, from the small number of the preceding and present races available, that such is not the case in the dry interior. Except that the breast is more deeply tinged cartridge buff, the type of *pallescens* is similar to other specimens from central and inland Western Australia. The single example from Wongan Hills in its darker upper parts reflects the proximity of that locality to the range of *A. c. multi*, and it is apparent that *G. c. westernensis* was described from a similar specimen.

Acanthiza chrysorrhoa multi Mathews.

Acanthiza chrysorrhoa multi Mathews, Nov. Zool., xviii, 1912, p. 351;
Wilson's Inlet, Western Australia.

Range.—Form north of Perth, south-east to the southern coast and east towards the South Australian border.

Specimens Examined.—Twenty-nine from the following localities: Perth Herdsman's Lake, Gracefield, Mandurah, Harvey River, Beverley, Dumbleying, Broome Hill, Wonerup, Cape Naturaliste, Ellensbrook, Lake Muir, Wilson's Inlet, Albany, Bannister, Stirling Ranges, Lake Dundas, Zanthus.

Measurements.—Twenty-nine adult specimens of both sexes: wing, 54-62 (59); tail, 37-43 (41·3); exposed culmen, 9·5-11 (10); tarsus, 17-18·5 (17·5).

Subspecific Characters.—Most closely resembling *addenda* but under surface white prominently tinged pinkish buff rather than deep olive-buff, and under tail-coverts white; upper parts more brownish, light brownish olive, with mouse grey nape.

This race is sharply distinct in colouration from *A. c. ferdinandi*. Most available specimens are from localities in, or bordering on, the area of good rainfall (30-40 inches) in south-west Australia. It is surprising, therefore, to find *multi* represented by two examples from Lake Dundas and Zanthus, both of which localities are in generally arid country similar to that inhabited by *ferdinandi*. Possibly the presence of these birds in that class of country resulted from a movement induced by temporary suitable conditions, but more material from a wide area is essential for a proper understanding of the distribution of these two forms in Western Australia.

GRAPTOLITES OF VICTORIA: A LOWER
ORDOVICIAN MONOGRAPTUS FROM BENDIGO.

By R. A. Keble, F.G.S.,

Palaeontologist, National Museum.

(Plate XVII.)

A specimen, unique to Victoria, has been found at Bendigo by Mr. Frank Chambers, of the Geological Survey. It occurs on a slab of soft blue shale and consists of a flat spiral polypary with the family characters of the Monograptidae. The associated graptolites are *Tetragraptus fruticosus* (3 br.) J. Hall, very common and well preserved, and several other species common to Zone B2. The horizon is, therefore, Lower Ordovician, Bendigo Series. It is remarkable that a Monograptid should now be found in such an association for the first time at Bendigo where intensive collecting has been in progress for thirty years and tens of thousands of identifications have been made.

The family Monograptidae, erected by Lapworth (4) in 1873, comprises unilateral Graptolitoidea, with a polypary simple or compound, straight or curved, with thecae varied in form, growing upward in a single linear series along the line of the virgula. It embraces the genus *Monograptus* erected by Geinitz (3) in 1852 and characterized by a simple polypary, with thecae consisting of cylindrical, conical or somewhat flattened tubes, in contact, overlapping, or becoming more or less isolate, with straight or curved walls and apertural margins variable in form, plain or ornamented. In the majority of species the polypary is distinctly curved (see Elles and Wood, 2), and in a few the curvature is excessive and continuous, the polypary being coiled into a plain spiral (*M. convolutus*) or a conical helix (*M. turriculatus*).

In the Bendigo specimen, the polypary is not well preserved. Only the portion which has been laterally compressed shows indistinctly the character of the thecae; the rest has been compressed along the dorsal margin, which probably accounts for the varying width of the polypary. The sicula is hidden from view by an overlying graptolite, *T. fruticosus* J. Hall. The flat spiral polypary and thecae growing upwards in a single linear series leave no other alternative than to place

it among the Monograptidae. The polypary is robust. Near its proximal end it is 1.0 mm. wide, at its distal extremity 2.0 mm.; both measurements of dorsally compressed portions of the polypary. Thecae on convex margin, are straight, circular tubes of small diameter, overlapping a small fraction of their length, with even apertural margins; 5 or 6 in 10 mm. On the proximal thecae, thick blunt spines originate from the outer lip; on more distal thecae the spines become thinner and longer; and on the most distal thecae, no spines are visible, but they may have been obscured by the mode of compression. There is some evidence of a virgula.

The straight, circular, scarcely-overlapping thecae suggest that it is a primitive type, one that shows "simplification in branching, and change in direction of growth . . ." (1) characteristic of Silurian species occurred very early in the evolution of the Monograptidae.

The specimen was found in Tucker Gully, Bendigo, bearing N 39° 10' E, 27.75 chains from the True Blue shaft; Reg. No. 14050, National Museum collection.

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DESCRIPTION OF PLATE XVII.

Monograptus sp. Polypary, No. 14050, Nat. Mus. Coll., from the Lower Ordovician Beds, Zone B2, Bendigo. × 6 approx.

GOLDSTEIN'S *NOMINA NUDA* OF CATENICELLIDAE (BRYOZOA).

By *Leo. W. Stach, B.Sc.*,

MacBain Research Scholar in Zoology, University of Melbourne.

(Plate XVIII.)

The collection of J. R. Y. Goldstein, an early worker on the Recent Bryozoa of Victoria, was recently discovered at the premises of the Royal Society of Victoria and has since been presented in part to the National Museum. The bulk of the collection consists of Recent Bryozoa, including European species obtained from A. W. Waters by exchange, portion of the material described by Goldstein from the Marion Islands (1882) and bulk material from Port Denison and Holborn Island (Queensland), the faunules of which were described by Haswell (1880).

Of more particular interest to the author was the discovery of balsam mounts partly supplying the key to Goldstein's *nomina nuda* of Catenicellidae published in Jelly's catalogue (1889); these form the subject of this contribution. Enquiries made by Sir Sidney F. Harmer for the author at the British Museum (Nat. Hist.) and at the Manchester Museum, have added considerable information to the subject, and my acknowledgments are due to him and to Miss Hastings, Ph.D. (Brit. Mus.) and Miss Legge (Manchester Mus.).

The material here considered was collected in the Bass Strait region; no exact localities are indicated on the original labels, but the specimens probably come from the Bracebridge Wilson dredgings taken at Port Phillip Heads.

The following inferences have been drawn, from the facts now come to light, regarding the reason for the publication of the *nomina nuda* and the previous history of these names. The series of balsam mounts, including previously described species and Goldstein's MS. species, appear to have been prepared at the one time since the balsam is baked to the same colour and similar labels, with the inscriptions written in lead pencil, are used in all cases. Of the previously-described forms, "*Catenicella wilsoni* Macgillivray, 1880, is the latest allotted a name in the series of slides, thus fixing the earliest

limit of the erection of these names. On the evidence of "*Catenicella*" *constricta* Goldstein MS., which was described by Macgillivray (1884) as "*Catenicella*" *utriculus*, the latest limit is defined.

A bound series of "jellygraph" copies of drawings by Busk in the British Museum (Nat. Hist.), bearing the inscription in Busk's handwriting: "These are all original figures from specimens, excepting *Calpidium ornatum*. Nov., 1881," contains figures of specimens of the *nomina nuda* in question and therefore these specimens must have been examined by Busk prior to this date. A copy of this MS. work of Busk, obtained on loan through Sir Sidney F. Harmer from the British Museum, showed that there is nothing in the explanation of the figures to indicate that Goldstein's forms were MS. species and, since Miss Jelly is known to have possessed a copy of this work, it is presumed that she regarded them as having been described, but not knowing where they were described, she included them in the catalogue for the sake of completeness. The placing of two of Macgillivray's species described in 1887 in the synonymy of Goldstein's MS. species is also thus explained.

Goldstein apparently confused the application of his MS. names, for some of them are applied to different forms. From Busk's "jellygraphs," drawings made by Sir Sidney F. Harmer of slides in the Manchester Museum (Waters and Jelly Collections) and the series of slides under consideration, the following correlation is made:

Catenicella constricta = *Vittaticella utriculus* (Macgillivray, 1884) in present series (Nat. Mus. Coll., No. 69247).

Catenicella inflata = *Vittaticella elegans robusta* var. nov. in present series (Nat. Mus. Coll., No. 69248).

Catenicella maccoyi = ? *Scuticella margaritacea* (Busk, 1852) in Busk's "jellygraphs" (p. 7); a slide labelled thus is described by Bale (1922) as *Claviporella goldsteini* sp. nov. (= *Claviporella imperforata* Macgillivray, 1887).

Catenicella monstrosa = *Scuticella subventricosa* sp. nov. in present series (Nat. Mus. Coll., No. 69249) and in the Jelly Collection (Manchester Museum).

Catenicella perplexa = *Scuticella margaritacea* (Busk, 1852) in Busk's "jellygraphs" (p. 4).

Claviporella bicornis = *Claviporella imperforata* Macgillivray, 1887, in Busk's "jellygraphs" (p. 1, as *Catenicella* (*Calpidium*) *bicornis* Goldst.).

Claviporella cacatua = *Claviporella imperforata* Macgillivray, 1887, in present series (as *Catenicellopsis cacatua*, Nat. Mus. Coll., No. 69250); in Busk's "jellygraphs" (p. 1, as *Calpidium saccatum* Goldstein in explanation of figures and *Catenicellopsis* (*Calpidium*) *cacatua* Goldst. written on figure); in the Waters Collection (Manchester Museum), No. H 1186 as *Catenicella cacatua* Goldst. The specimen labelled *Claviporella cacatua* in the Jelly Collection (Manchester Museum) appears to be *Claviporella pulchra* Macgillivray, 1887.

In addition to these, the following two unpublished MS. names occur in the series of slides under consideration: *Catenicella oculata* Goldst. MS. = *Scuticella urnula* (Macgillivray, 1887) (Nat. Mus. Coll., No. 69251); *Catenicella pyriformis* Goldst. MS. = *Vittaticella castanea* (Thomson, 1858) (Nat. Mus. Coll., No. 69252).

Family CATENICELLIDAE Busk, 1852.

Subfamily Vittaticellinae Stach, 1933.

Genus VITTATICELLA Maplestone, 1901.

Vittaticella elegans robusta var. nov.

(Pl. XVIII, figs. 1, 2, 3.)

Catenicella elegans (pars) Busk, 1852, p. 10, pl. ix, figs. 1, 2.

Catenicella inflata Goldstein MS., Jelly, 1889, p. 37 (*nomen nudum*).

Vittaticella elegans (Busk), Waters, 1913, p. 484, pl. lxxv, figs. 1-7, 12.

Dimensions.—Zooecium: length, 0.55 mm., width, 0.30; aperture: diameter, 0.09.

Observations.—This form, which was first figured by Busk from South Africa, differs from the typical *V. elegans* (Busk, 1852) from Bass Strait in that the vittae extend nearly to the level of the proximal rim of the aperture and the general dimensions are greater. The avicularia tend to be more robust and are often greatly developed on one side of the zooecium.

Vittaticella castanea (Thomson).

(Pl. XVIII, figs. 4, 5, 6, 7.)

Catenicella castanea Thomson, 1858, p. 138, pl. xiii, fig. 3.*Catenicella pyriformis* Goldstein MS.

Description.—Zooecium elongate-ovate in outline; greatest width, at middle level of zooecium, equals about half length of zooecium. The slightly concave proximal rim is situated in the middle third of the zooecium one-third of the distance from distal to proximal connecting-tube apertures. Height of aperture equals about half the distance from the proximal rim to the distal connecting-tube aperture.

The triangular scapular compartments, at level of aperture, project laterally. The suprascapular compartments, small in extent, face obliquely laterally. The vittae, facing directly laterally, extend from slightly below level of proximal rim to distal connecting-tube aperture and communicate by a single row of nine to eleven septula.

Axis of daughter zooecium inclined at about 35° to that of mother zooecium. The sub-circular ovicell, barely projecting above frontal of distal zooecium, has a crenate margin formed by ten to twelve depressions.

Dimensions.—Zooecium: length, 0.57 mm., width, 0.27; aperture: diameter, 0.09; ovicell: height, 0.23.

Observations.—The ovicell of this species is figured for the first time and proves to be of similar type to those of other species of *Vittaticella*. Thomson's figure, which illustrates the appearance of the vittae as seen in transparent balsam preparations, suggests that the vittae are forwardly directed. Goldstein's mounts show a similar appearance, but the vittae are clearly laterally-directed.

This species is characterized by the length of the vittae and the projecting triangular scapular compartments.

Vittaticella utriculus (Macgillivray).

(Pl. XVIII, figs. 12, 13.)

Catenicella utriculus Macgillivray, 1884, p. 32, pl. lxxxix, fig. 5.*Catenicella constricta* Goldstein MS., Jelly, 1889, p. 35.

Description.—Zooecium broadly ovate with triangular latero-distal projections; greatest width, at upper level of scapular compartments, is less than length of zooecium. The slightly concave proximal rim is situated in the middle quarter of the zooecium one-fifth of the distance between distal and proximal connecting-tube apertures. Height of aperture equals about two-thirds of the distance from the proximal rim to the distal connecting-tube aperture.

The triangular scapular compartments, at and above level of aperture, appear as prominent latero-distal processes. The suprascapular compartments, of small extent, are directed upward. The vittae, facing directly laterally, extend from slightly below level of proximal rim to distal connecting-tube aperture.

Axis of daughter zooecium inclined at about 45° to that of mother zooecium. Ovicell unknown.

Dimensions.—Zooecium: length, 0.66 mm., width, 0.42; aperture: diameter, 0.10.

Observations.—This species is characterized by its rotund zooecia and the conspicuous constriction between the distal termination of the vittae and the scapular compartments.

Sub-family **Scuticellinae** Stach, 1934.

Genus **SCUTICELLA** Levinsen, 1909.

Scuticella subventricosa sp. nov.

(Pl. XVIII, figs. 8, 9, 10, 11.)

Catenicella monstrosa Goldstein MS., Jelly, 1889, p. 38 (*nomen nudum*).

Description.—Zooecium semi-elliptical in outline, the suprascapular compartments extending distally beyond level of distal connecting-tube aperture; greatest width, at level of scapular compartments, equals about two-thirds length of zooecium.

The slightly convex proximal rim, with median shallow sinus, is situated in the middle third of the zooecium about one-third of the distance proximally from the distal connecting-tube aperture. Height of aperture equals three-quarters of the distance from the proximal rim to the distal connecting-tube aperture.

The ovate sternal area has five to seven fenestrae, the most distal pair, when present, being of smaller size and occurring close to the proximal angles of the aperture.

The scapular compartments, normally at the level of the aperture, usually face directly laterally. The suprascapular compartments face upward and project distally into acute processes above the level of the distal connecting-tube aperture. The distal infrascapular compartments extend to the middle level of the zooecium, the proximal infrascapular compartments extending to the proximal connecting-tube aperture; both are laterally-directed.

Axis of daughter zooecium inclined at about 40° to that of mother zooecium.

The terminal gonoeonium is oval in outline and surmounted latero-distally by a pair of laterally-directed avicularia with acute distal processes. The transversely semi-elliptical sternal area has five fenestrae. The proximal rim of the transverse aperture has a median broad shallow sinus. The supra-apertural area generally has a median and two lateral distally-placed small fenestrae, a median frontal pair and lateral large pair of proximal fenestrae. A pair of lateral compartments occurs on each side facing laterally.

Dimensions.—Holotype: Zooecium: length, 0.63 mm., width, 0.46; aperture, diameter: 0.16; gonoeonium: length, 1.15, width, 0.80; aperture: width, 0.38, height, 0.20.

Variation.—Apart from the normal variation occurring in Catenicellidae (Stach, 1934) the following points are noted: The avicularia usually face laterally, but may vary greatly in size, some extending from the distal con-

necting-tube aperture to a level at about two-thirds of the distance from distal to proximal connecting-tube apertures. Forwardly-directed avicularia of small size occur rarely.

Type Material.—Holotype: Balsam mount of fragment with ovicells. Nat. Mus. Coll., No. 69249.

Affinities.—The labelling of Goldstein's slide indicates that he originally confused this form with *S. ventricosa* (Busk, 1852), from which it differs notably in the form of the gonoeecium. The zooecial characteristics are the occasional abnormally large avicularia and the inconspicuous distal pair of the seven fenestrae.

Observations.—No slide labelled "monstrosa" occurs in the Goldstein series and the identification is based on camera lucida drawings, sent me by Sir Sidney F. Harmer, of a slide labelled "*Catenicella monstrosa*" from the Jelly Collection at the Manchester Museum. The label on the holotype slide bears the words "Cat. ventricosa (*ventricosa* erased) with monster avic.," and thus also supplies a clue to its identification. Harmer's notes (*in litt.*, 6-vi, 1934) on the Manchester specimen confirm the identification.

The gonoeecium of this form illustrates an early stage in the evolutionary trend culminating in the modified terminal gonoeecium which predominates in Scuticellinae. The terminal gonoeecium appears to have been derived from the Vittaticellinid type, where the ovicell pertains to two single zooecia. The suggested developmental trend is that the endozooecial ovicell gradually became restricted to the proximal zooecium, ceasing to overlap the distal zooecium which subsequently failed to develop, thus causing the ovicelligerous zooecium to terminate a branch. In the gonoeecium of this species, homologues of all the lateral compartments present in a normal zooecium are readily recognizable and there is even a suggestion of the vestige of a distal connecting-tube aperture.

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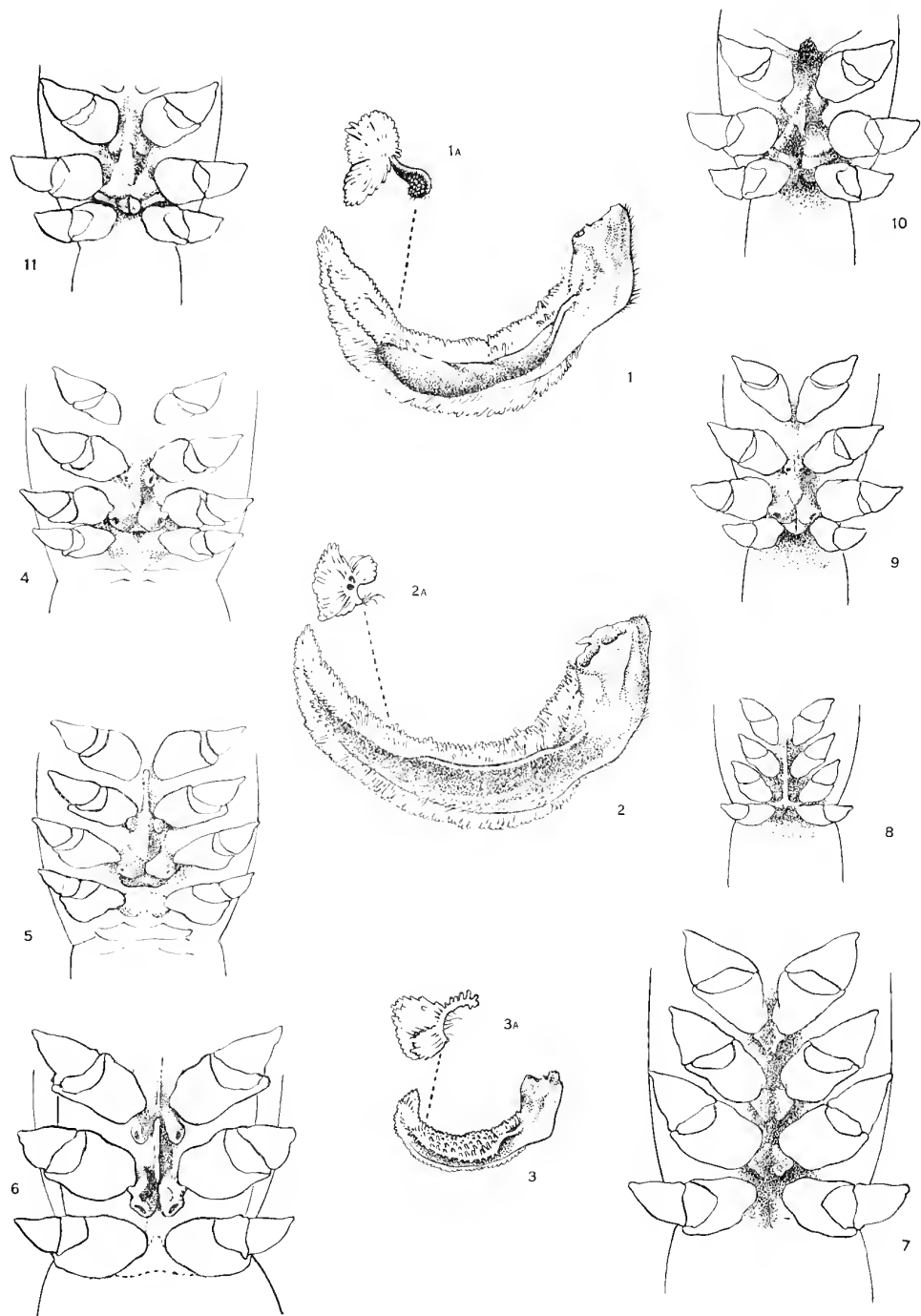
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EXPLANATION OF PLATE XVIII.

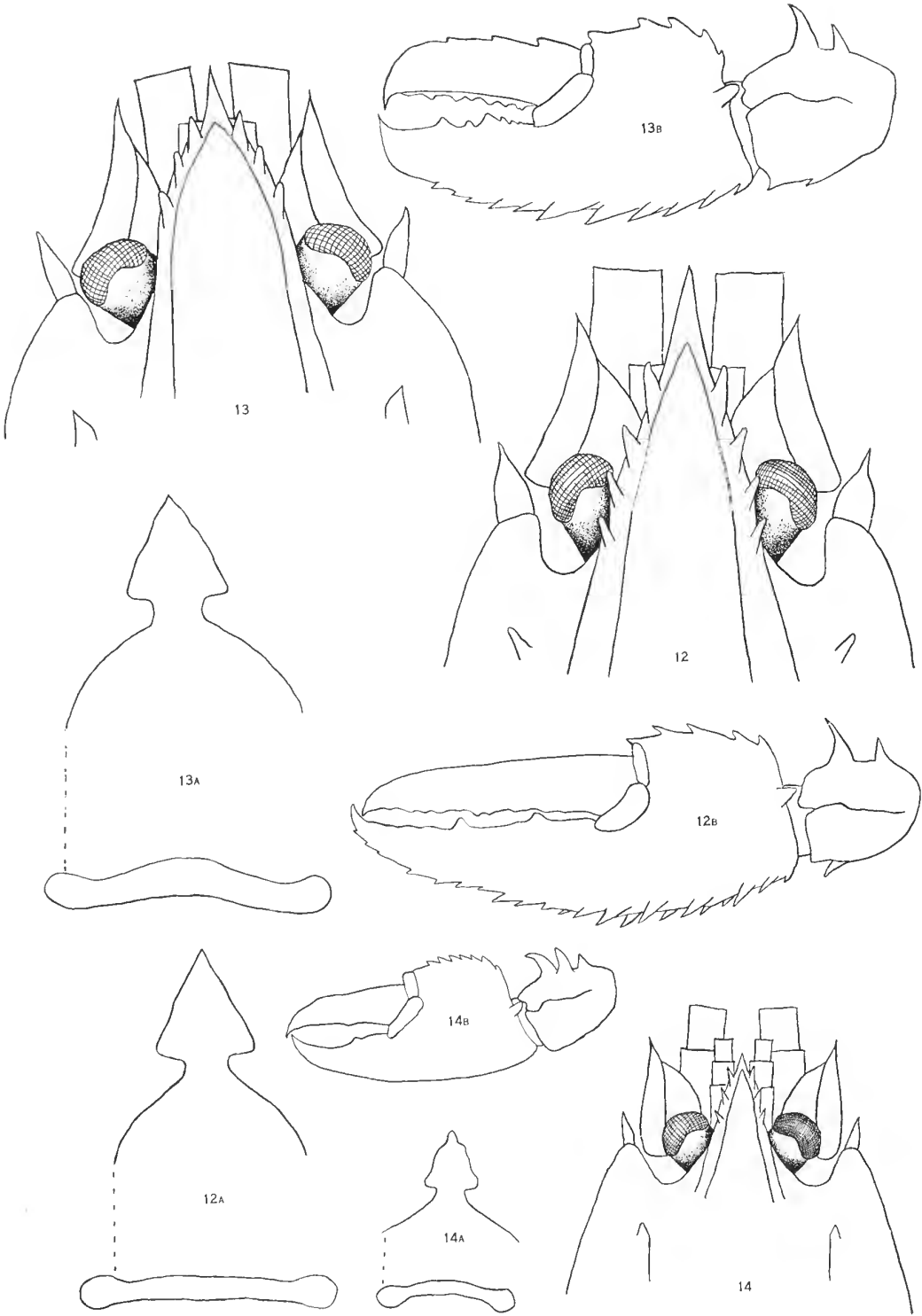
(Magnification: $\times 60$.)

- Fig. 1. *Vittaticella elegans robusta* var. nov. Geminate pair from Victoria. Nat. Mus. Coll., No. 69248.
- Fig. 2. *V. elegans robusta*. Normal single zooecium from Victoria. Nat. Mus. Coll., No. 69248.
- Fig. 3. *V. elegans robusta*. Single zooecium with large avicularium. Nat. Mus. Coll., No. 69248.
- Fig. 4. *Vittaticella castanea* (Thomson, 1858). Single zooecium. Nat. Mus. Coll., No. 69252.
- Fig. 5. *V. castanea*. Geminate pair. Nat. Mus. Coll., No. 69252.
- Fig. 6. *V. castanea*. Lateral view of ovicelled zooecium. Nat. Mus. Coll., No. 69252.
- Fig. 7. *V. castanea*. Frontal view of ovicelled zooecium. Nat. Mus. Coll., No. 69252.
- Fig. 8. *Scuticella subventricosa* sp. nov. Frontal view of terminal gonoecium from Victoria. Nat. Mus. Coll., No. 69249.
- Fig. 9. *S. subventricosa* sp. nov. Single zooecium with large avicularium. Nat. Mus. Coll., No. 69249.
- Fig. 10. *S. subventricosa* sp. nov. Geminate pair. Nat. Mus. Coll., No. 69249.
- Fig. 11. *S. subventricosa* sp. nov. Single zooecium. Nat. Mus. Coll., No. 69249.
- Fig. 12. *Vittaticella utriculus* (Macgillivray, 1884). Single zooecium from Victoria. Nat. Mus. Coll., No. 69247.
- Fig. 13. *V. utriculus*. Geminate pair. Nat. Mus. Coll., No. 69247.



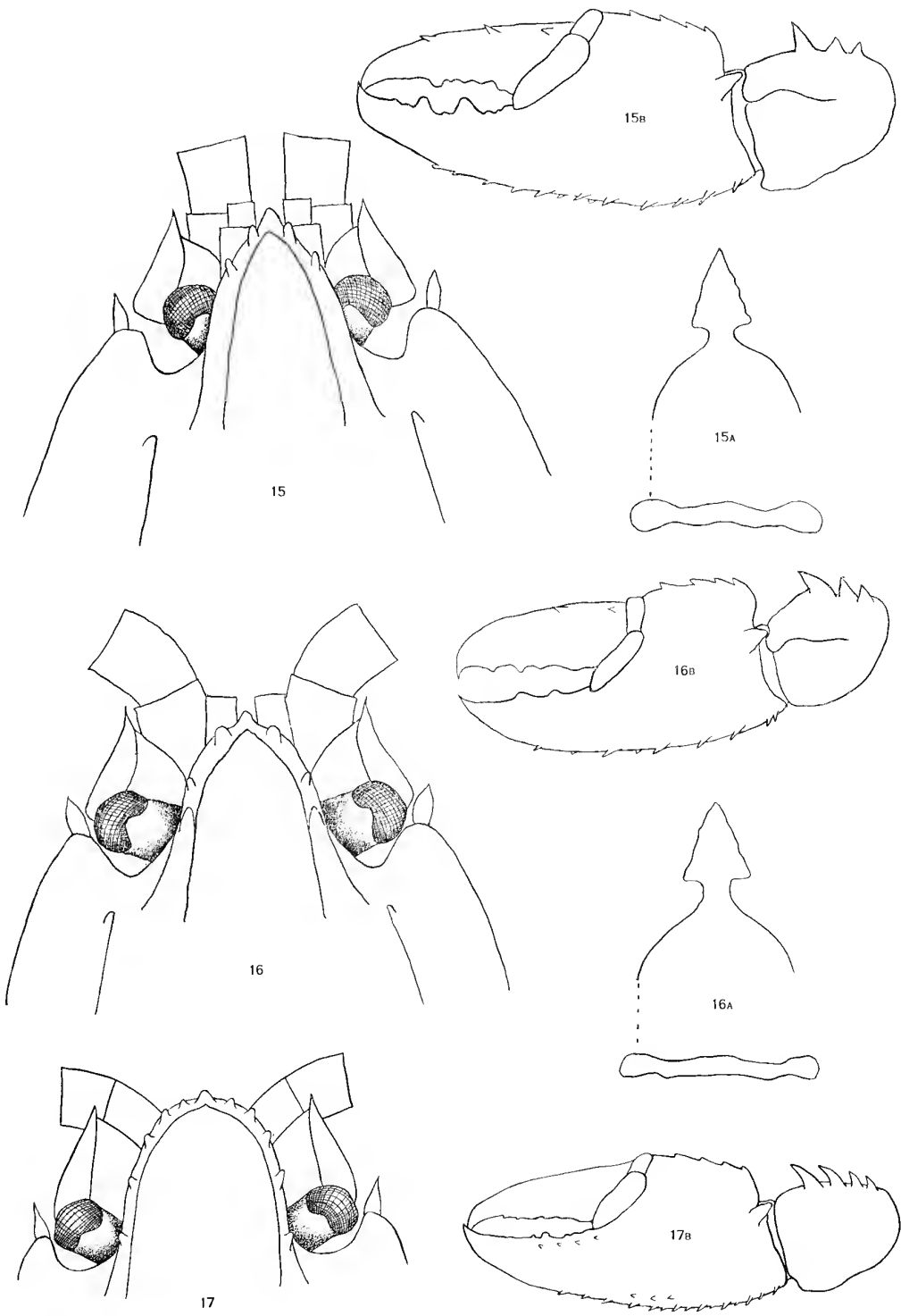
GJB

Australian Parastacidae



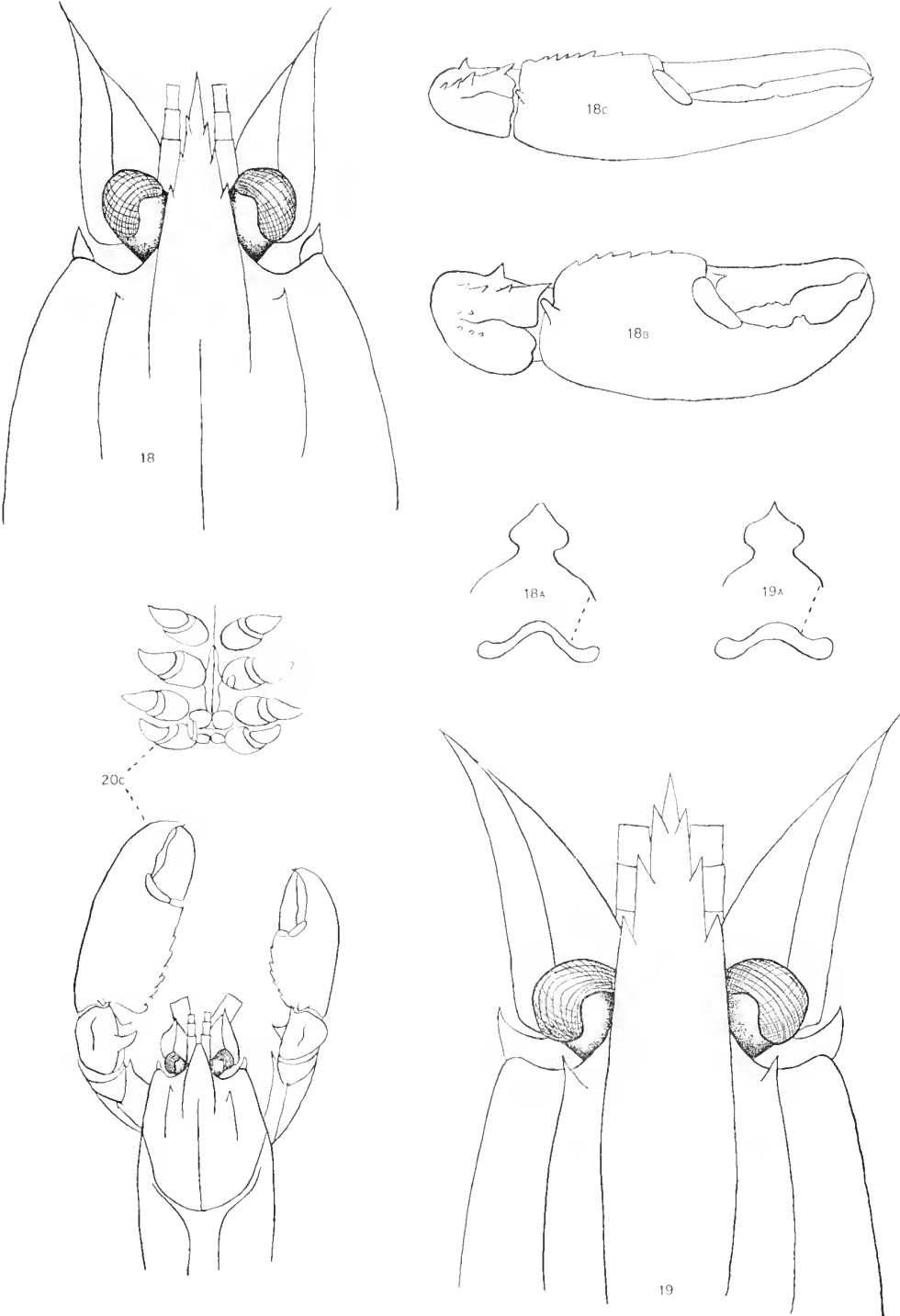
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Australian Parastacidae



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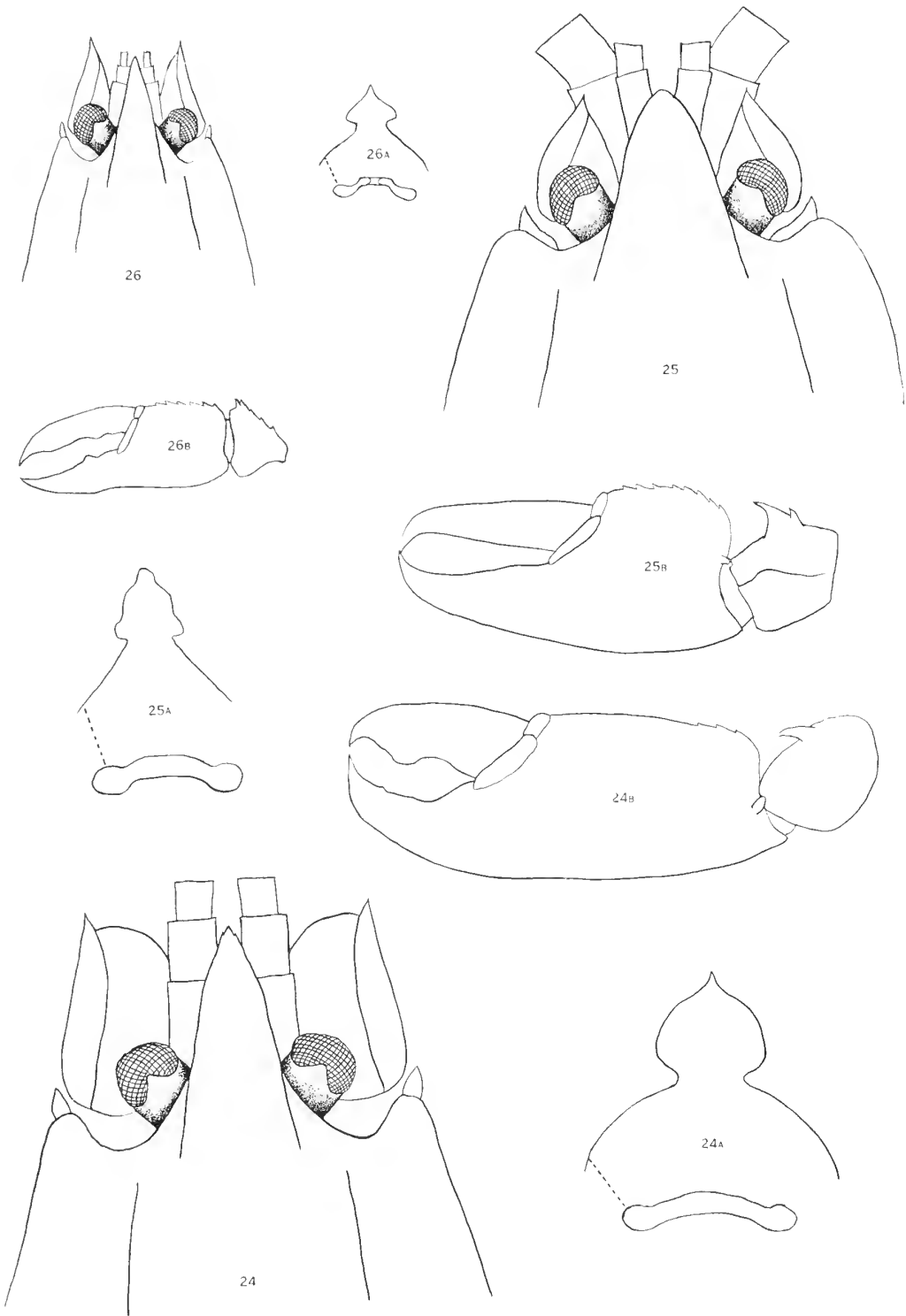
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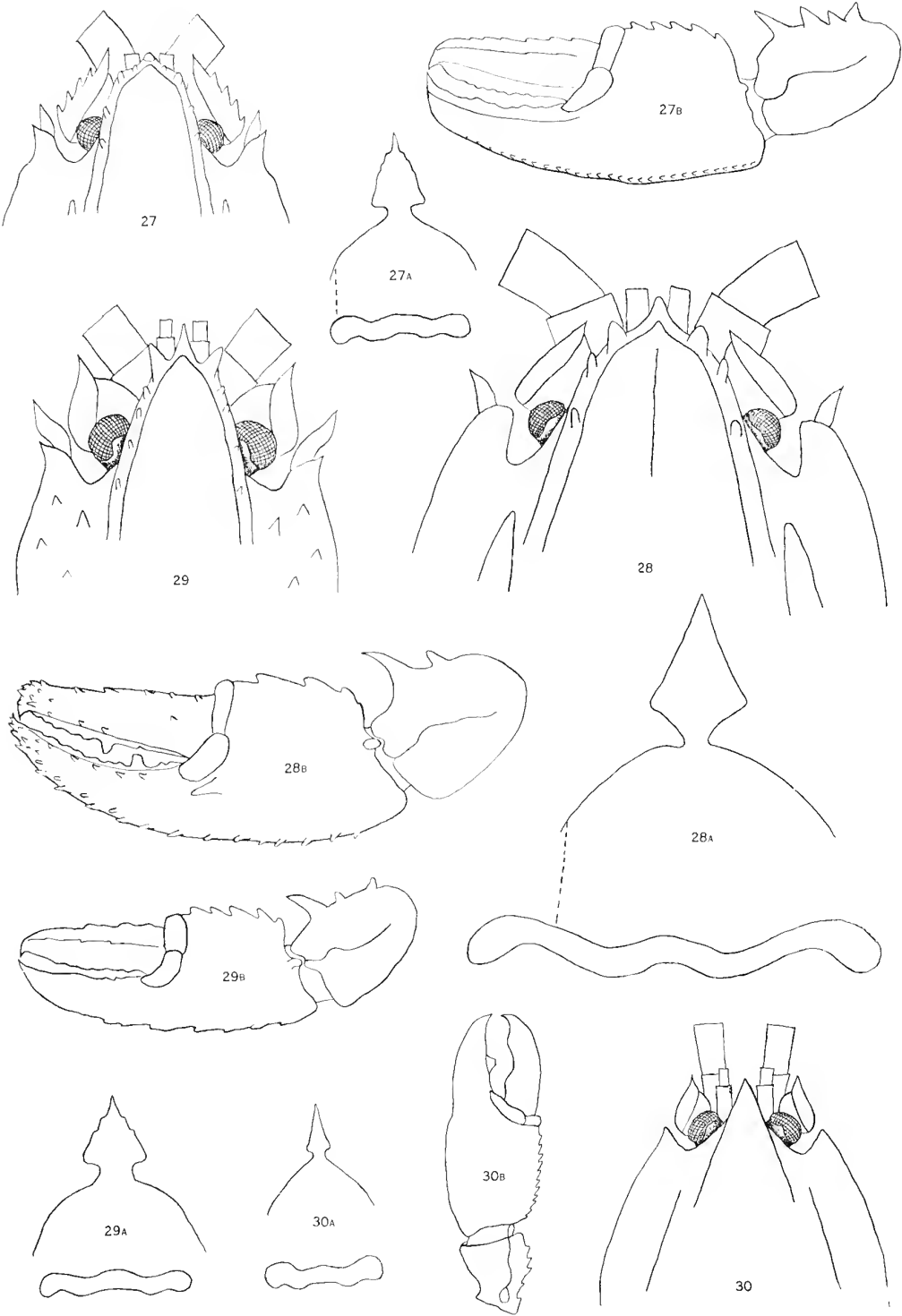
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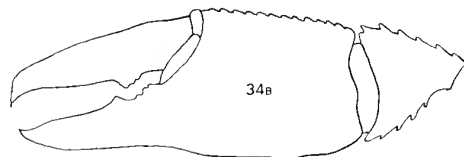
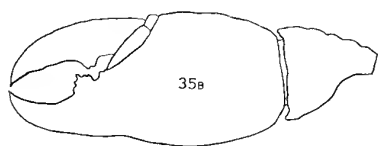
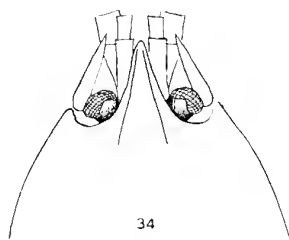
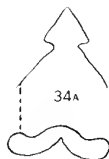
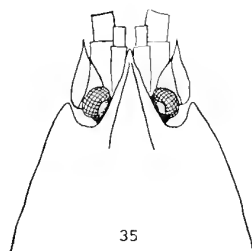
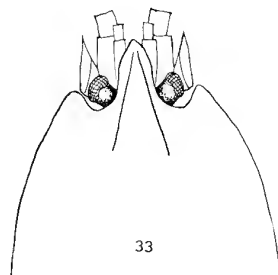
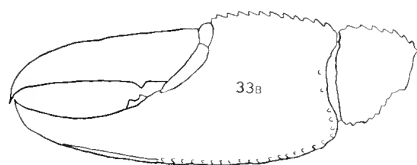
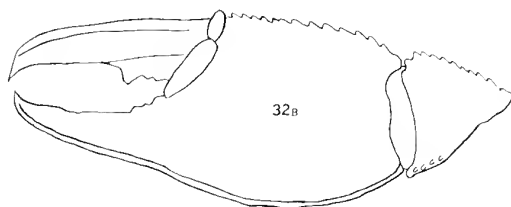
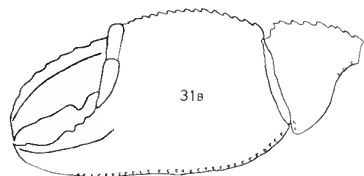
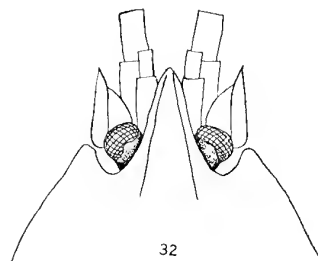
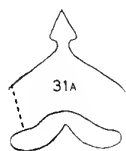
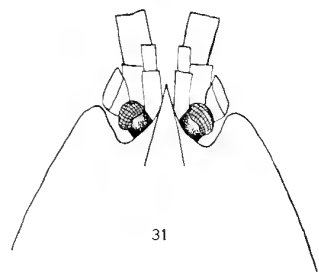
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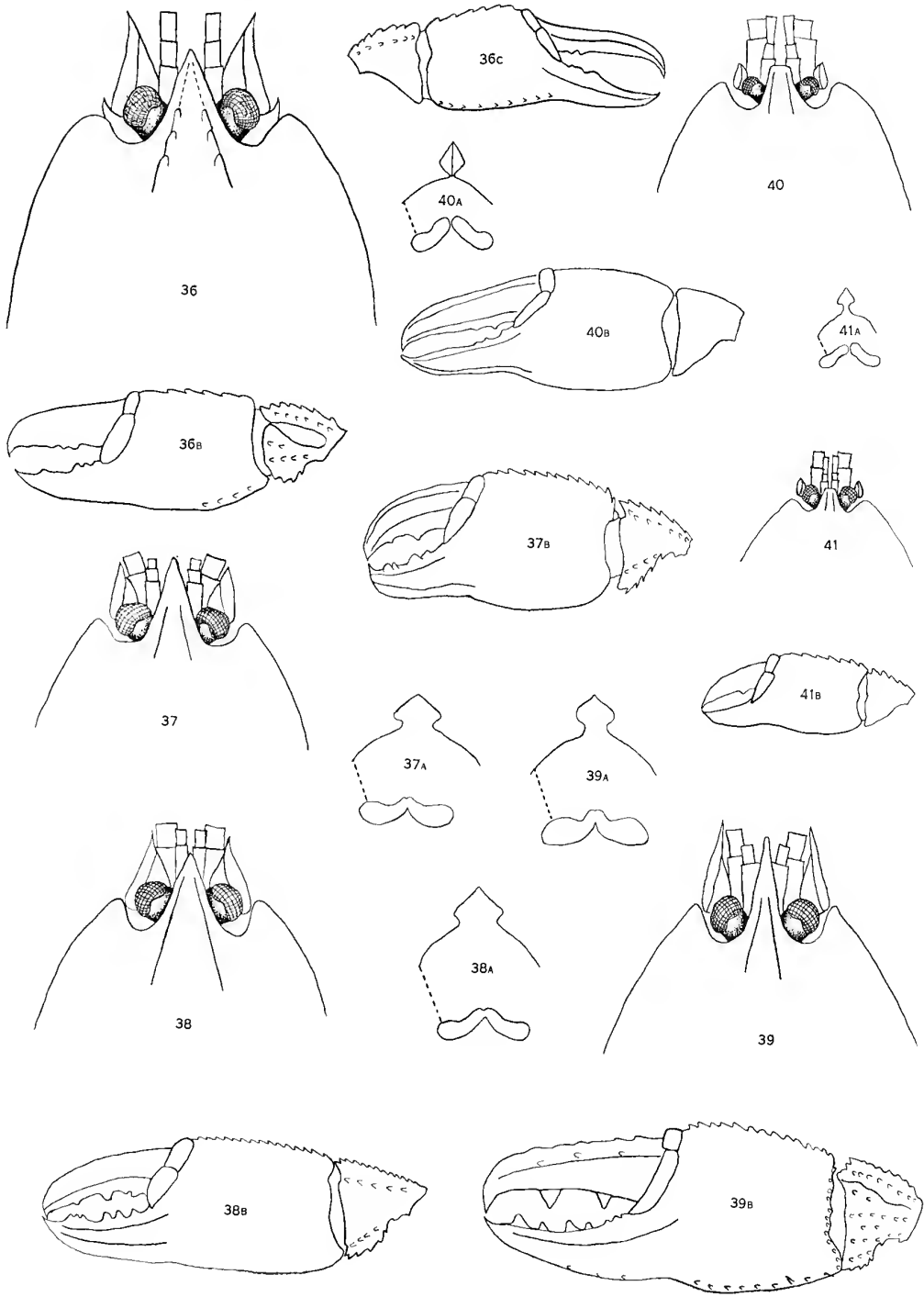
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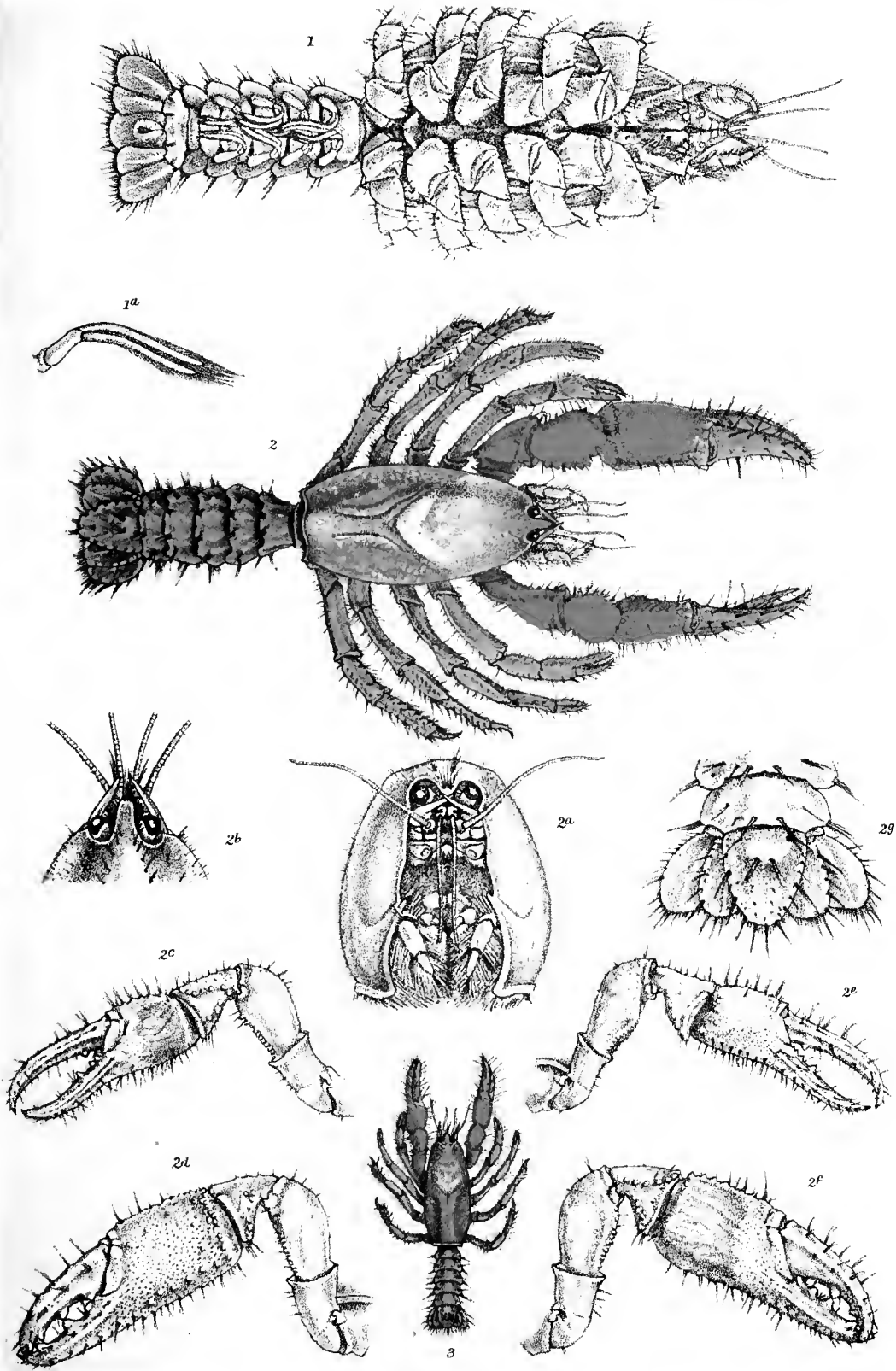
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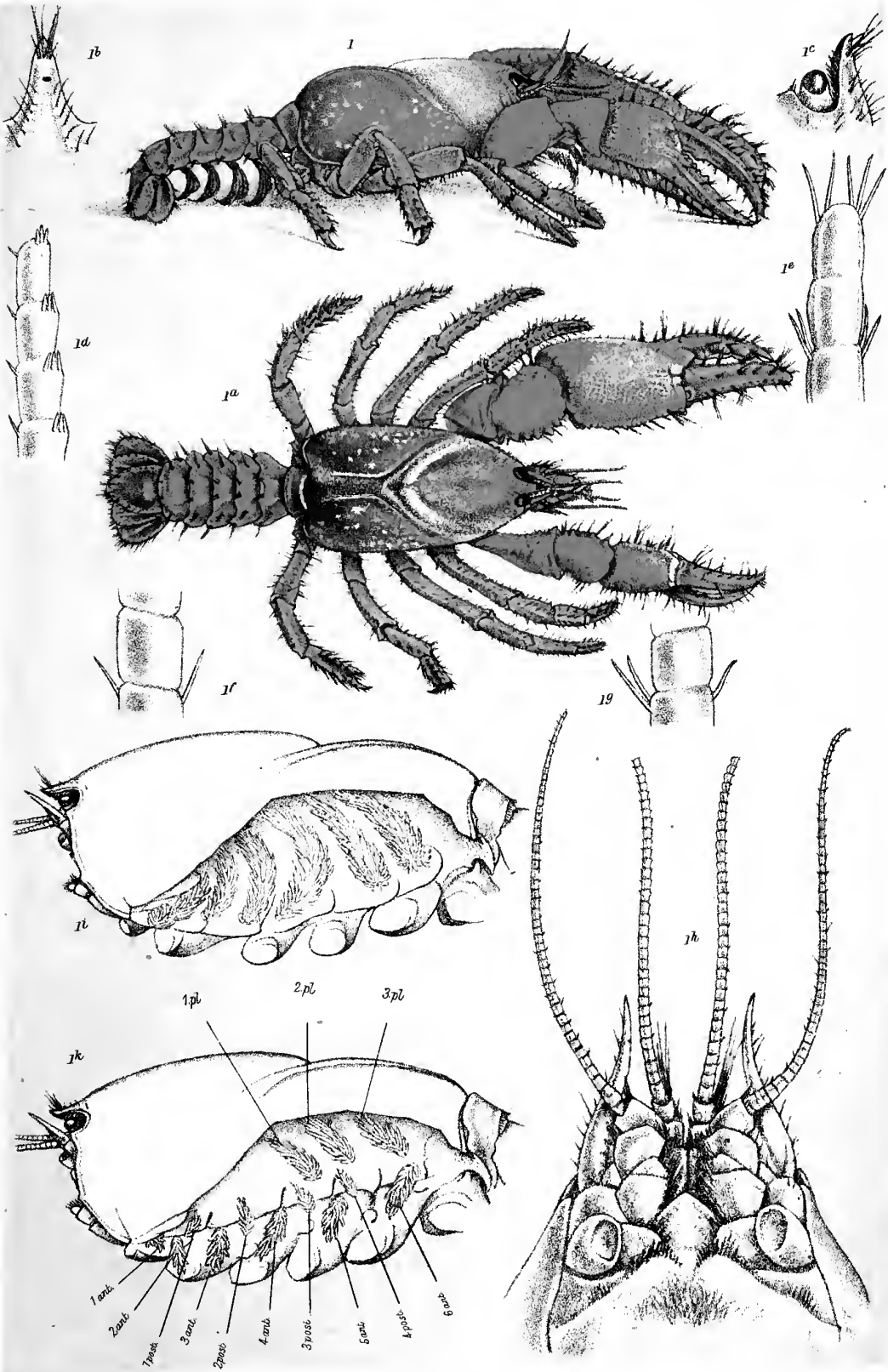


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Austroastacus hemicirratulus (Sm. and Sch.)

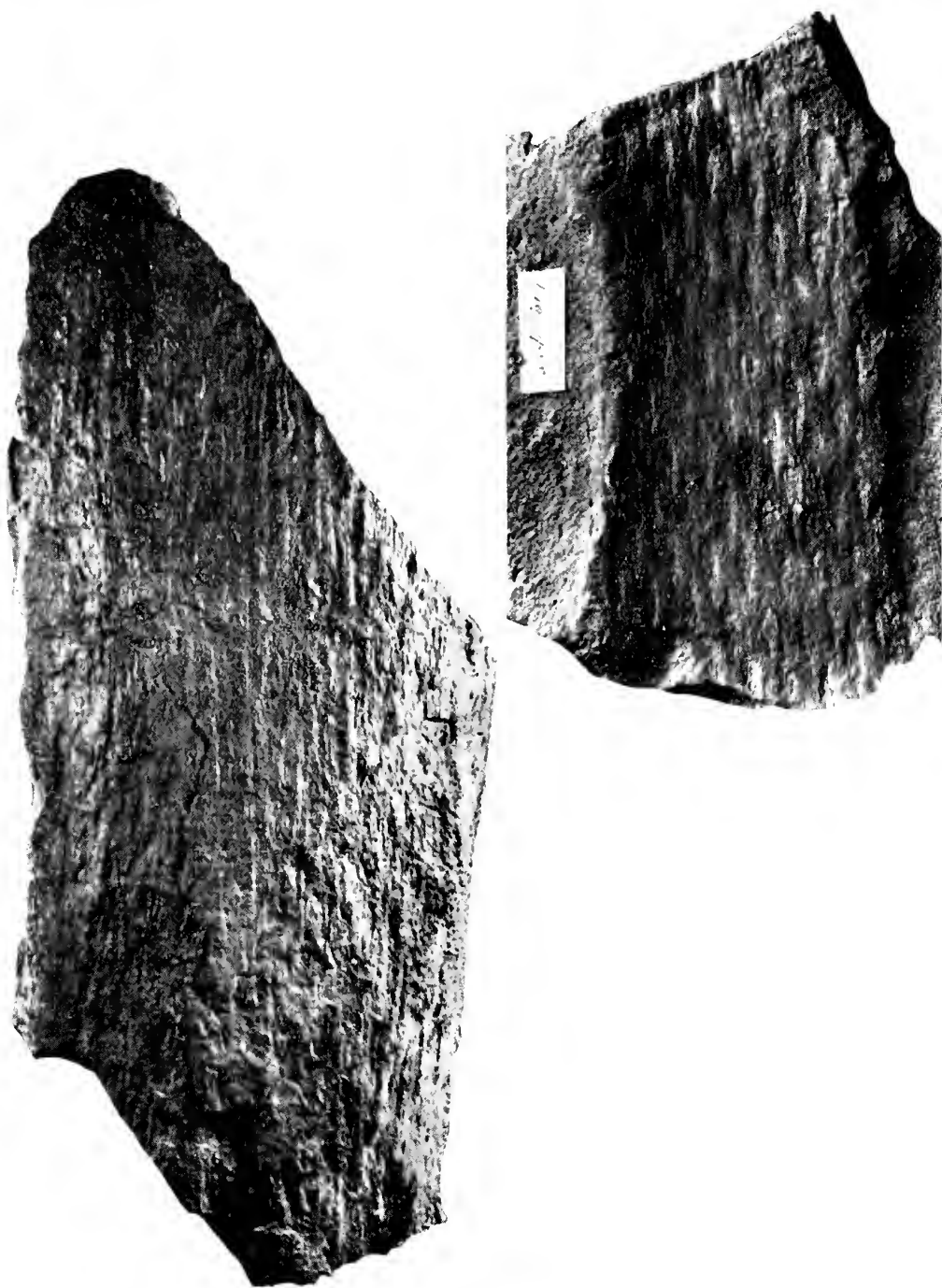


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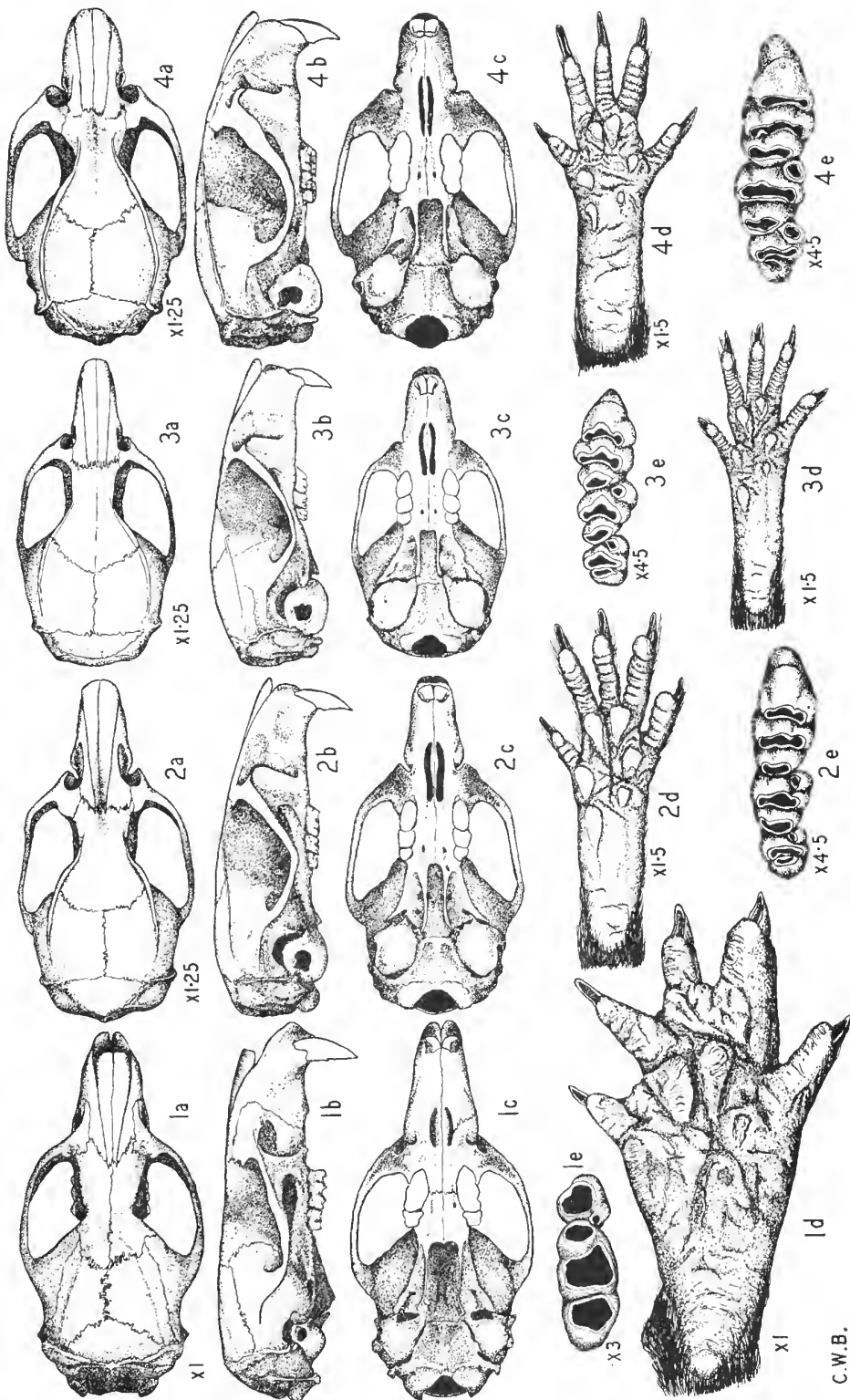
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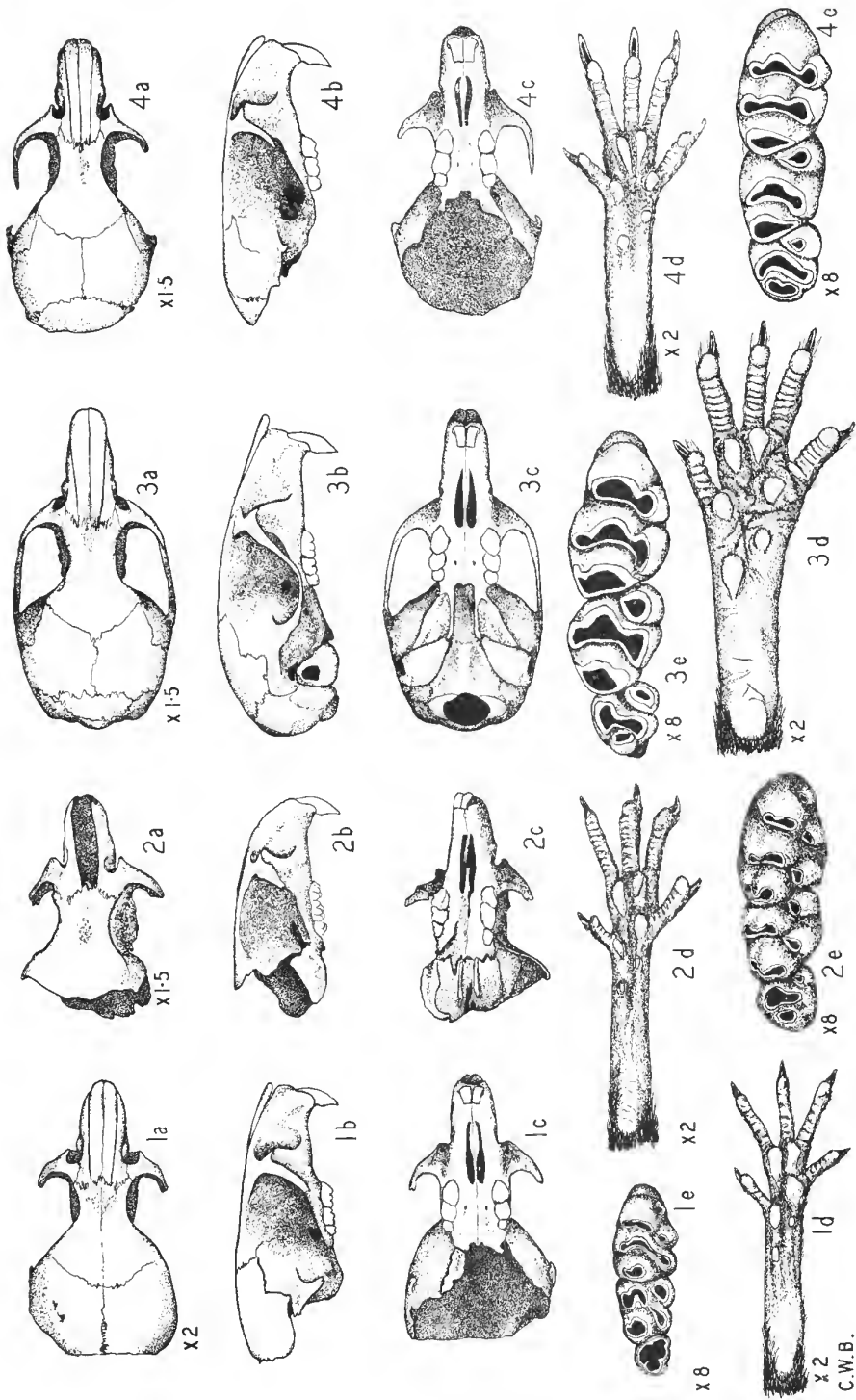


Lepidodendron Veltheimianum Sternberg from Mansfield.
(*L. mansfieldense* McCoy MS.)



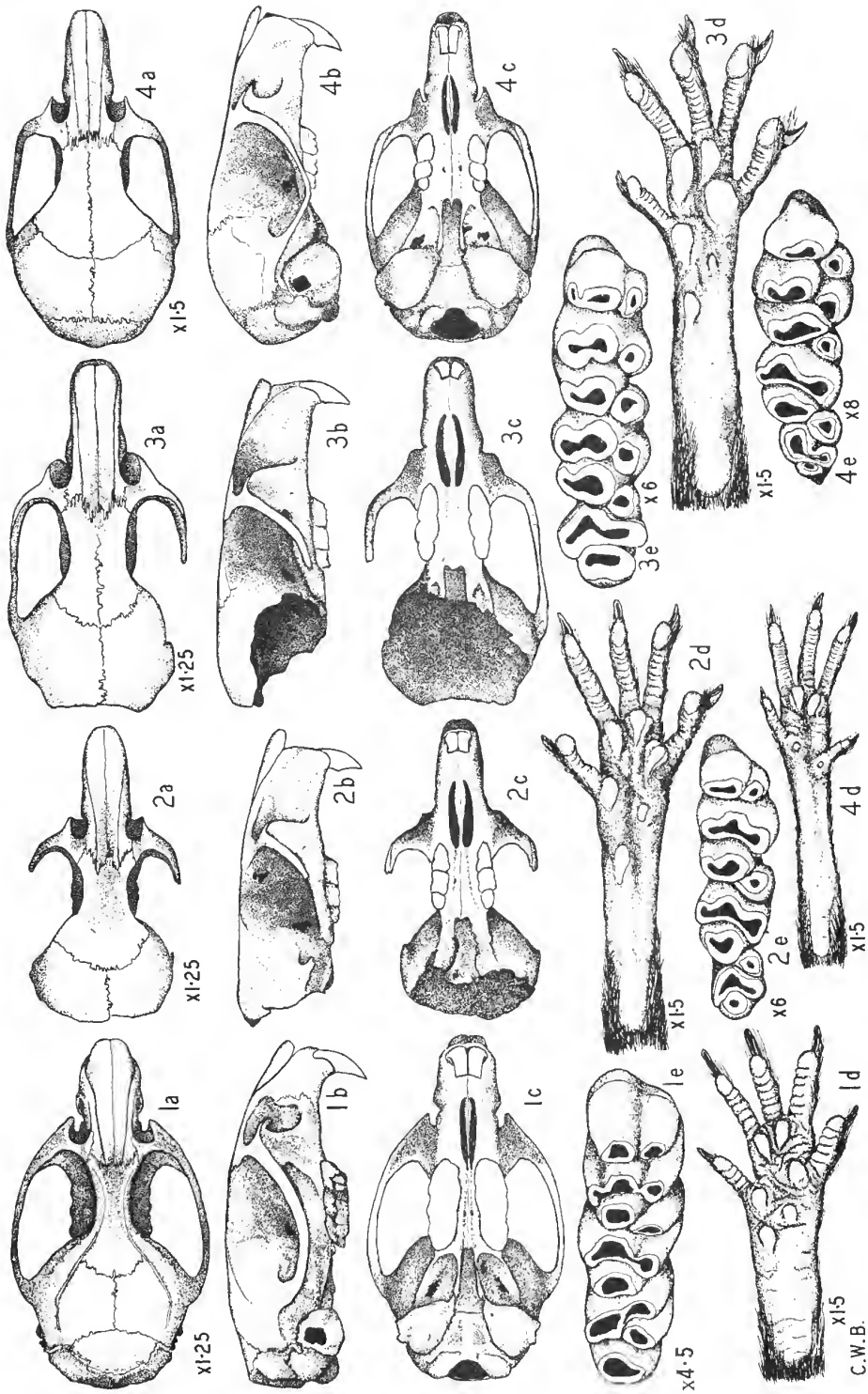
Muridae

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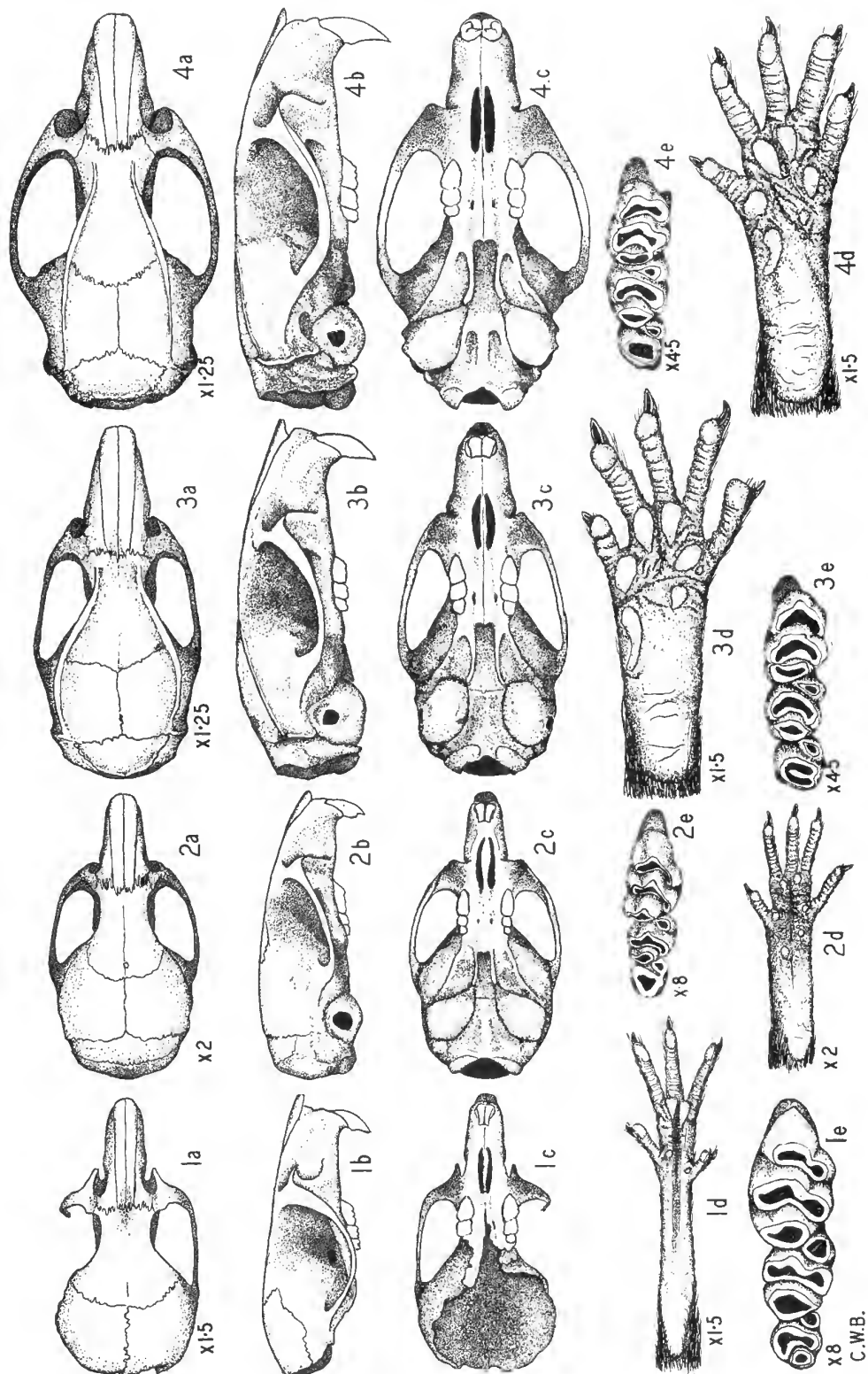
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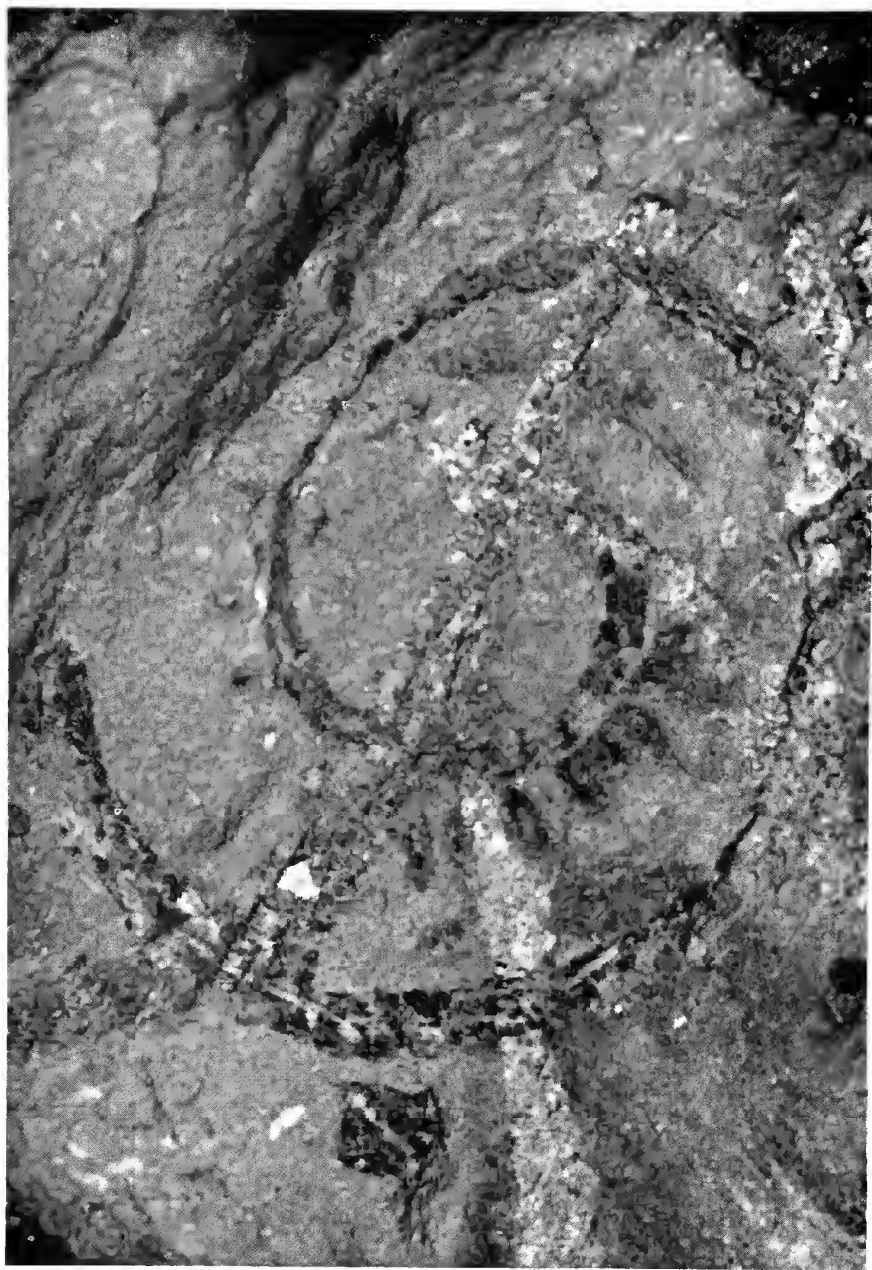
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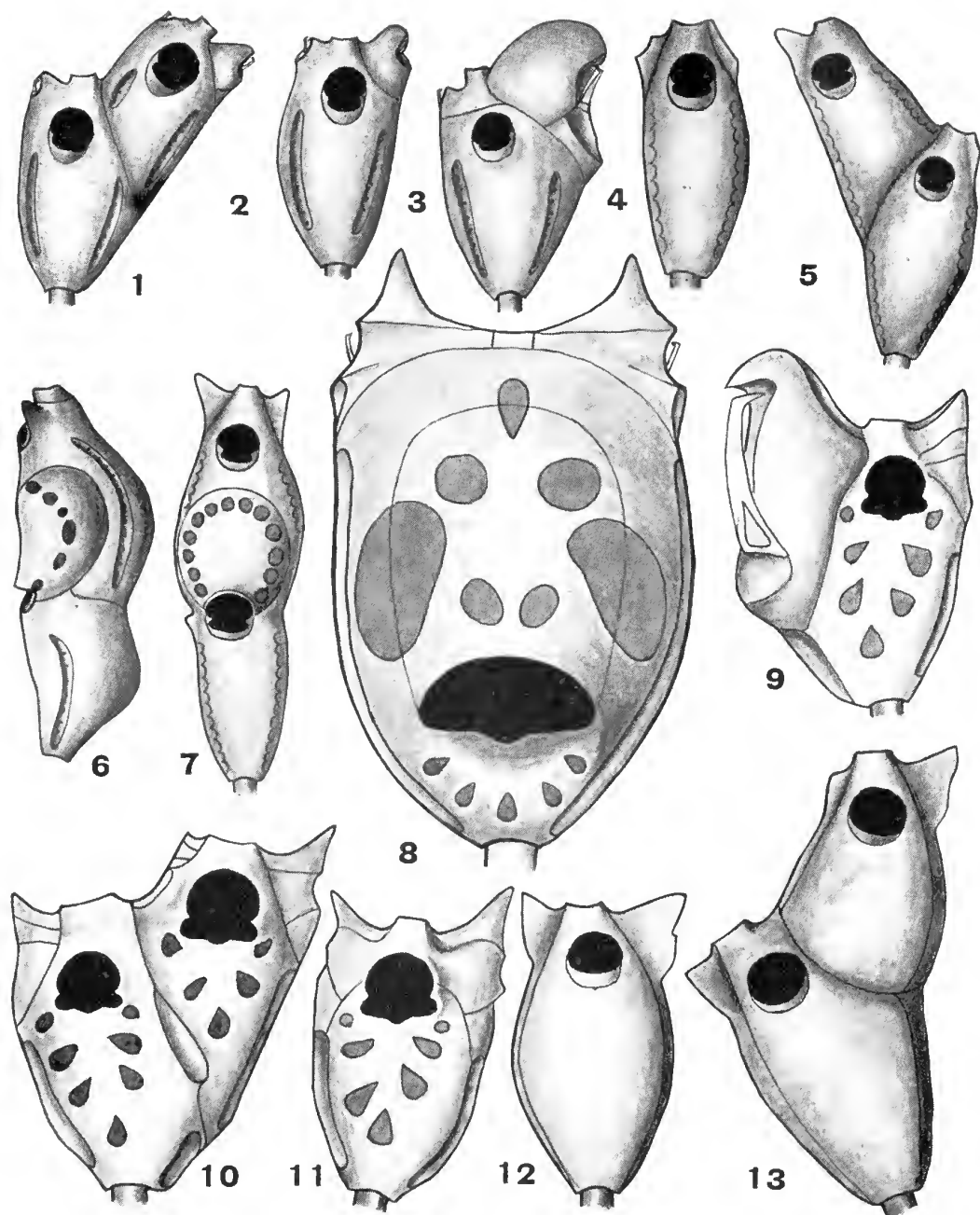


Muridae

C.W.B.



Monograptus sp.
× 6 approx.



Recent Catenicellidae

